

Study of Serum Minerals Levels in HypothyroidismReetu Rani¹, Santosh Kumar², Sudha Kumari³, P. P. Gupta⁴¹Tutor, Department of Biochemistry, Darbhanga Medical College, Laheriasarai, Bihar.²Assistant Professor, Department of Biochemistry, Darbhanga Medical College, Laheriasarai, Bihar.³Associate Professor, Department of Biochemistry, Darbhanga Medical College, Laheriasarai, Bihar.⁴Professor and HOD, Department of Biochemistry, Darbhanga Medical College, Laheriasarai, Bihar.

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Conflict of interest: Nil

Abstract

Background: In light of their direct effect on bone turnover, thyroid function problems, especially hypothyroidism, have drawn more attention recently as a significant source of disruption in mineral metabolism. Many important metabolic pathways that are either directly or indirectly controlled by thyroid hormones require calcium, phosphorus, and magnesium. Research on hypothyroid individuals has yielded conflicting results. Therefore, this study was conducted to assess changes in mineral status by measuring serum levels of calcium, phosphorus, and magnesium in hypothyroid patients and to note the significance of monitoring these levels in subclinical hypothyroid disorders.

Methods: In this study 50 known hypothyroid patients on analysis with serum T3, T4 and TSH were included as cases and 50 clinically healthy volunteers included in the control group in age group between 18 and 75 years. Thyroid hormones were measured by Electrochemiluminescence Immunoassay method and Calcium, Magnesium, Phosphorus measured on autoanalyzer.

Results: Our study demonstrated normal T3 and T4 level and increased level of TSH in cases suggesting subclinical hypothyroidism. In this study patients show normal serum total calcium, and increased total magnesium and serum phosphorous levels as compared to healthy control that is there is alteration in mineral levels.

Conclusion: As this study shows alteration in minerals levels monitoring of serum levels of these minerals will be helpful in hypothyroid patients. Alteration in these minerals needs to be monitored periodically and proper treatment should be given to the patient.

Keywords: Hypothyroidism, Mineral, Monitoring, Subclinical.

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Introduction

Thyroid disorders are one of the most common endocrine disorders. [1] Endocrine disorders are common among Indian population, out of which thyroid disorders represents an important subset of these endocrine disorders.[2] However, in India, Unnikrishnan et al. conducted a study in eight different cities and found a high prevalence of hypothyroidism (10.95%), affecting approximately 1 in 10 adults in the population.[3]

Recently, the disorders of thyroid function particularly hypothyroidism is receiving greater attention as an important cause of disturbance in mineral metabolism by their direct action on bone turnover [4] and also as one of the causes for secondary osteoporosis. Calcium (Ca²⁺), phosphorus (PO₄²⁻), and magnesium (Mg²⁺) are all divalent metal ions, which are necessary for metalloenzymes and various crucial metabolic

pathways directly or indirectly regulated by thyroid hormones. Few animal studies have proposed that thyroid hormones act as long-term regulators for phosphate metabolism, and the free T3 elevates renal phosphate reabsorption and elevates serum phosphate levels in rats.[5]

Literature has revealed serum levels of hypocalcemia and hyperphosphatemia in the commonly occurring thyroid dysfunction, hypothyroidism. [6,7] Few studies have revealed disturbance in magnesium metabolism in hypothyroidism too.[8] Serum magnesium was observed to be increased in hypothyroid disorders as per the literature.[9] Even though the changes in the calcium and magnesium account to slight levels in thyroid disorders, these disturbances were vital for the patients in long run.[8] Studies on hypothyroid subjects have shown contradictory

findings Hence, this study was undertaken to evaluate alteration in mineral status by estimating serum calcium, phosphorus, and magnesium in patients having hypothyroidism and to observe the importance to check the levels of these minerals in subclinical hypothyroid disorders.

Materials and Methods

This study was conducted at Department of Biochemistry, Darbhanga Medical College, Laheriasarai, and Bihar from August 2025 to October 2025. Written Informed consent from the subjects was obtained. Duration of study was 3 months

In this study 50 known hypothyroid patients on analysis with serum T3, T4 and TSH were included as cases and 50 clinically healthy volunteers included in the control group in age group between 18 and 75 years.

The subjects with Pediatric age group, Renal disorders, Hepatic disorders, Bone diseases, Cushings syndrome, DM, Pregnancy excluded from the study. 3ml of fasting venous blood sample was drawn from the cases and controls. Serum was separated and immediately tested for calcium, phosphorus and magnesium and Thyroid hormones

by semi autoanalyser. Comparison of the all parameters between cases and controls was conducted by unpaired t test and expressed as Mean±Standard Deviation. $p < 0.05$ was considered as significant and $p < 0.0001$ were considered as statistically highly significant respectively.

Results

Our result shows there is decrease in T3 and T4 levels in cases as compared to controls and it is not significant ($p > 0.05$). But the TSH level markedly increased in cases as compared to the control and statistically highly significant (< 0.0001). Among the minerals, when the cases and controls were compared, there was a significant variation in the values between the two groups. Phosphorus level increased in cases as compared to the control ($p < 0.05$) and statistically significant. Magnesium levels in serum is significantly elevated in patients with hypothyroidism when compared to controls ($p < 0.05$). Calcium there is slight increase in levels but within normal range in cases as compared to controls and it is not significant ($p > 0.05$). The mean age in the controls and cases were 35.96 years and 36.24 years respectively. Out of 50 cases 42 were female and 8 were male and out of 50 control 40 were female and 10 were male.

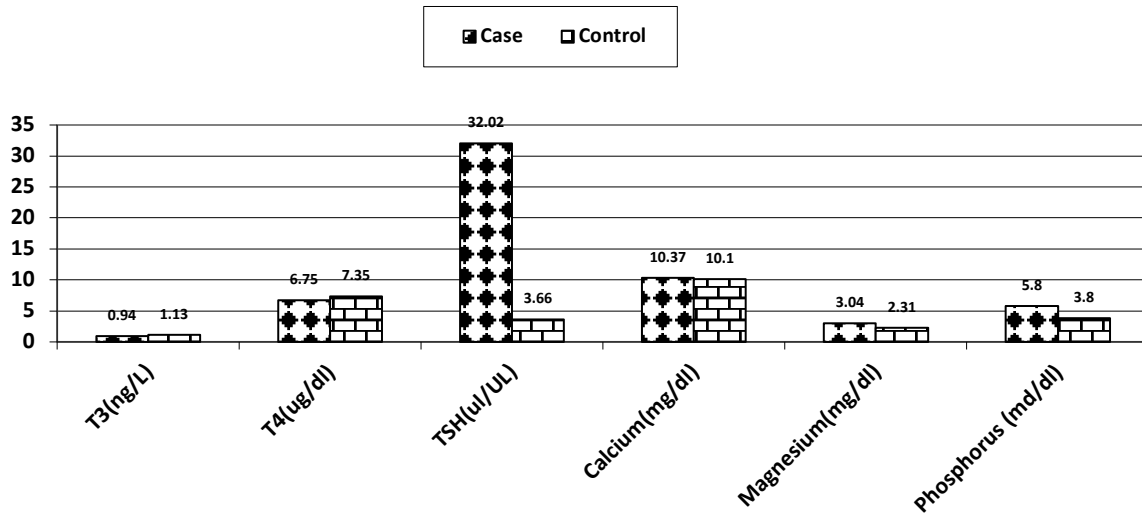


Fig. 1: Comparison of T3, T4, TSH, serum calcium, phosphorous and magnesium in controls and cases

Table 1: Comparison of age, sex, T3, T4, TSH, serum calcium, phosphorous, magnesium in controls and cases

Parameters	Cases	SD	Control	SD	P Value
T3(ng/ml)	0.94	0.34	1.13	1.3	>0.05
T4(ug/ml)	6.75	2.88	7.35	2.1	>0.05
TSH(uIU/ml)	32.02	46.62	3.66	1.54	<0.0001
Calcium(mg/dl)	10.37	2.25	10.1	0.7	>0.05
Magnesium (mg/dl)	3.04	2.16	2.31	0.3	<0.05
Phosphorus (mg/dl)	5.8	3.29	3.8	1.58	<0.05

Discussion

Thyroid diseases are primarily conditions that affect the amount of thyroid hormones being produced.[10] Hypothyroidism is characterized by a broad clinical spectrum ranging from an overt state of myxedema, end-organ effects and multisystem failure to an asymptomatic or subclinical condition with normal levels of thyroxine and triiodothyronine and mildly elevated levels of serum thyrotropin.[11]

Patients with subclinical thyroid disease have few or no symptoms or signs of thyroid dysfunction and thus by its very nature subclinical thyroid disease is a laboratory diagnosis.[12]

In this study 8 out of 50 patients were suffering from hypothyroidism whereas 42 out of 50 had subclinical hypothyroidism. When serum Calcium levels was compared between cases and control there was no significant change seen ($P>0.05$) this is in contrast with Shivallela et al. demonstrated a significant decrease in serum calcium of SCH group than control.

This is mainly due to the low levels of Parathyroid hormone and low levels of calcitonin in hypothyroidism.[4] Roopa and Soans reported that thyroxin normally regulates blood calcium level by releasing calcium from cells, by decreasing thyroxin level in blood, less T4 enters the cells and less calcium is released [13] in our study as there is no decrease in T4 level there is no significant change in calcium level that could be reason of normal serum level of calcium. Animal study done by Kumar and Prasad concludes that renal calcium excretion was increased in rats with high TSH levels.[14]

In this study when serum phosphorus levels was compared between cases and control there was increase in phosphorus level in cases as compared to controls which is statistically significant $< p.0.05$ that may be due to increased production of thyroid calcitonin which promotes the tubular reabsorption of phosphate and tubular excretion of calcium, resulting in hyperphosphatemia and hypocalcemia, respectively.[15] Similar result was seen in study done by Abbas MM et al.,[16] Alcalde et al[5] and Schwarz C et al.[17] and opposite result shown by Gammage[18] who state that there is decrease in phosphorus in hypothyroidism And Suneel et al.,[15] who reported that there was a significant decrease of the mean phosphate in patients with hypothyroidism compared to control.

In this study when serum magnesium levels was compared between cases and control there was increase in magnesium level in cases as compared to controls which is statistically significant $< p.0.05$ similar result shown by Jaskin K, [19] Schwarz

[17] and Frizel.[9] Frizel in his study states that both plasma magnesium and ionized magnesium were increased in hypothyroidism.[9] Murgud et al. exhibited significantly elevated levels of serum magnesium compared to the controls ($p<0.001$).[4]

McCaffrey et al., study states that renal retention of magnesium was due to 15-30% increased reabsorption of the filtered magnesium in thyroid deficient rats at any given plasma concentration as the thyroid hormones had direct effect on the tubules.[20] Our findings were contradictory to Abedelmula M, et al.,[21] shows opposite result stating that significant decrease in serum Magnesium levels in hypothyroid group compared to controls.

Conclusion

Our study demonstrated normal T3 and T4 level and increased level of TSH in cases suggesting subclinical hypothyroidism in this study patients show normal serum total calcium, and increased total magnesium and serum phosphorous levels as compared to healthy control that is there is alteration in mineral levels.

So monitoring of serum levels of these minerals will be helpful in hypothyroid patients. Alteration in these minerals needs to be monitored periodically and proper treatment should be given to the patient. As there is the importance of minerals in the metabolism of thyroid hormones we need to elaborate our study to a larger scale.

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