



AN EVALUATION OF SERUM ELECTROLYTES LEVEL AMONG PATIENTS HAVING HYPOTHYROIDISM

Biochemistry

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ABSTRACT

Introduction: Hypothyroidism, the commonest form of hormonal dysfunction, is due to thyroid hormone deficiency or its impaired activity. Various electrolyte disturbances in association with hypothyroidism were observed in many studies

Objectives- To assess and analyse the alterations in the levels of serum calcium, magnesium and phosphorous and their relationship with T3, T4 and TSH in patients of hypothyroidism.

Material and Methods- We conducted a case control study were 120 known cases of hypothyroidism and 120 age and sex match controls were selected. Blood sample for analysis was collected from all the subjects and serum T3, T4, TSH, magnesium, calcium, sodium and phosphorous were estimated in all the subjects.

Results- The levels of calcium, sodium and potassium were significantly decreased in cases then controls. Serum phosphorous ($p < 0.0001$) and magnesium ($p < 0.0001$) were significantly increased among cases compared to controls.

Conclusion: A regular follow up of these serum minerals should be done in thyroid hormone deficiency which would be of great help in its management.

KEYWORDS

Electrolytes, T3, T4, Thyroid Stimulating Hormone (TSH).

Introduction

Electrolytes plays a significant role in many body changes, such as controlling fluid levels, acidbase balance (pH), nerve conduction, blood clotting and muscle contraction [1]. In India, 42 million people are suffering from thyroid diseases; hypothyroidism being the commonest thyroid disorder [2]. Thyroid hormones perform a wide array of metabolic functions including regulation of lipid, carbohydrate, protein and electrolyte and mineral metabolisms. Biochemically decrease in T3 and T4 concentration leads to hyper secretion of pituitary TSH and an amplified increase in serum TSH levels. This is a key laboratory finding, particularly in the early detection of thyroid failure. [3] Deranged thyroid hormones result in significant elevation in phosphate levels. [4] They are also believed to influence calcium metabolism.[5] While the effect of thyroid hormones on lipid metabolism is well known, the effect on electrolytes and minerals has not been well established and the underlying mechanisms are not well understood.[6] In recent years research has focused on outcomes of patients with electrolyte disorders, mainly hypo- and hypernatraemia, which were found to be associated with increased mortality. [7] In hypothyroidism increased production of thyroid calcitonin can promote the tubular reabsorption of phosphate and favours the tubular excretion of calcium. [8] Thus, the present study was undertaken to assess the alterations in the levels of serum electrolytes in hypothyroid patients.

Material and Methodology-

Study setting- The study was conducted in the Department of Biochemistry in collaboration with Medicine Department in Datia Medical College, Datia.

Study duration- July 2017 to January 2018

Study population- This study was taken up with 120 subjects who were hypothyroid as cases and 120 age and sex matched apparently normal healthy subjects from general population as controls.

Study design- Case Control study.

Inclusion criteria- Subjects between 20- 60 years age group were considered. Known hypothyroid patients on analysis with serum T3, T4 and TSH were considered as cases.

Exclusion criteria- Patients with incomplete thyroid function test, no significant thyroid history, renal disorders, hepatic disorders and hyperthyroid patients were excluded from the study.

Blood sample collection- After overnight fasting state and in aseptic

condition 3 ml of venous blood samples were collected in plain vial and was permitted to clot and centrifuged at 3000 rpm for 10 minutes at room temperature. Serum was separated and examined for T3, T4 and TSH by enzyme linked fluorescent assay (ELFA) technique using MiniVidas auto analyzer from Biomerieux.- ASHSIH3 Serum Magnesium13, Phosphorous14 and Calcium15 were estimated by Xylidyl blue, Phosphomolybdate and Arsenazo III methods respectively.

Ethical Considerations: Ethical Clearance was obtained from the institutional ethical clearance committee. After explaining the objectives of the study in detail, informed consent for involvement in the study was obtained.

Statistical Analysis

The recorded data were analysed using Epi-info software (version 7.1) and comparison of the above biochemical parameters between cases and controls was conducted by student t-test and expressed as Mean±Standard Deviation. Chi square test was used to determine the association between demographic factor and study participant. $p < 0.05$ was considered as statistically significant.

Results

Table 1- Age wise distribution of study participants (N=240)

Age groups (years)	Cases (%)	Controls (%)
20-30	15	16
31-40	22	23
41-50	47	47
51-60	36	34

$$\chi^2 = 0.112, df = 3, p\text{-value} = 0.99$$

Table 1 shows out of 120 cases the highest number of patients was found to be in 4th to 5th decade of life followed by age group of 51-60 years. This leads to the inference though hypothyroidism common in all age group but as the age increases the chances of thyroid disorder increases but the association between age and thyroid disorders was not found to be significant, which concludes that though hypothyroidism common in late age group but there is no association.

Table 2- Gender wise distribution of study participants (N=240)

Gender	Cases (%)	Controls (%)
Male	37	39
Female	83	81

$$\chi^2 = 0.07, df = 1, p\text{-value} = 0.78$$

Table 2 shows gender wise distribution as well as association with

cases and controls. Hypothyroidism is found to be female preponderance, but the association was not found to be statistically significant. This leads to the inference that though hypothyroidism common in females but there are other factors responsible as it is not causative.

Table 3- Comparison of different thyroid markers and electrolytes between cases and controls (N=240)

Tests	Cases	Controls	p-value
TSH	28.62±26.30	2.92±1.23	<0.001*
T3	0.41±0.311	2.27±0.63	<0.001*
T4	6.41±3.11	8.59±1.89	<0.001*
Ca	6.76±0.80	8.80±0.46	<0.001*
Na	126.42±10.62	138.40±3.18	<0.001*
K	3.86±0.22	5.92±1.58	0.07
P	4.88±0.44	3.62±0.42	<0.001*
Mg	2.27±0.18	1.20±0.22	<0.001*

*- p<0.05 is considered statistically significant

Table 3 shows when we compared cases and controls among the minerals, phosphorus and magnesium levels in the serum were significantly elevated in cases when compared to controls (p<0.001). The levels of calcium and sodium were significantly decreased in cases when compared to controls (p<0.001). However, serum potassium levels in hypothyroid patients were found to be less than that of controls but the difference was not statistically significant (p>0.001). T3, T4 and TSH levels were also compared between cases and controls T3, T4, TSH values were statistically significant.

Discussion

In the present study prevalence of hypothyroidism were found to be high in patients. Although all age group presented with a high prevalence of hypothyroidism, higher number of subjects was observed between age group of 41-50 years of age. Our study revealed that females are more vulnerable to hypothyroidism. Thyroid hormones are involved in metabolism of carbohydrate, lipid, protein and a mineral that is of various electrolytes, the hypothyroid patients generally suffer from a slow metabolism resulting in electrolyte disturbances. Frizel et al in their study found that the ionized magnesium and total magnesium levels were increased in cases which are in accordance with our study which shows that magnesium mean ± SD levels were higher in cases as compared to controls. [9] Al-Tonsi et al in their study found altered serum phosphates concentrations in patients with thyroid disorders. Their result also indicated a significantly elevated phosphate levels in the hypothyroid patients, which are also in accordance to our study which shows that phosphate level is elevated in the cases as compared to controls. Thyroid hormones play a central regulator of body hemodynamics, thermoregulation and metabolism. [4] Our study demonstrated a significant low level of serum calcium in cases then controls. Roopa et al also in their study reported that thyroxine (T4) normally regulates blood calcium level by releasing calcium from cells, by decreasing T4 level in blood, less T4 enters the cells and less calcium is released. [10] Schwarz C et al in their study of 9012 patients found that serum sodium was significantly lower in patients with high TSH levels that is cases, there was a significant correlation between serum TSH and phosphate level. Phosphates levels were higher in cases with elevated TSH then in controls. Serum calcium and magnesium correlated significantly with TSH. [11] Hypokalemia was more common in the group with elevated TSH then in those with normal TSH which is similar to our study. In a similar study conducted by Jaskiran Kaur et al and Bharti et al results were almost like our study. [12,13]

Conclusion

Our study demonstrated that hypothyroidism patients shows low serum electrolytes levels (calcium, sodium and potassium). Hence a regular follow up of these serum minerals should be done in thyroid hormone deficiency which would be of great help in its management. Keeping in mind the importance of minerals it is important to elaborate our study to larger population.

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Conflict of interest- none declared

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