



**ORIGINAL RESEARCH PAPER**

**Medicine**

**STUDY ON EVALUATION OF SERUM CALCIUM AND MAGNESIUM LEVELS IN SUBJECTS WITH THYROID DISORDERS IN OUR POPULATION**

**KEY WORDS:**

hypothyroidism, hyperthyroidism, calcium, magnesium, thyroid stimulating hormone.

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**ABSTRACT**

**Introduction:** Thyroid dysfunction and anatomic abnormalities of thyroid are common among the diseases of endocrine glands. Mineral metabolisms like calcium and phosphorous is frequently disturbed in thyroid dysfunctions. Thyroid hormones exert its effects on osteoblasts via nuclear receptors to stimulate osteoclastic bone resorption. **Objectives of the study:** To estimate and compare serum levels of calcium and magnesium levels in subjects with thyroid disorders (hypothyroidism and hyperthyroidism) and controls. **Materials and Methods:** A case control study on evaluation of serum levels of calcium and magnesium was conducted at Shri Balaji Institute of Medical Sciences and Hospital in the Dept. of General Medicine from January 2021 to June 2021 in subjects with newly diagnosed thyroid disorders. We evaluated serum levels of calcium and magnesium in these subjects. **Results & Discussion:** We included a total of 180 subjects, out of which 60 were hyperthyroid, 60 were hypothyroid and 60 were controls. We found that the levels of serum calcium were significantly decreased and magnesium levels were significantly elevated in hypothyroid subjects when compared to healthy controls and similarly serum calcium were significantly elevated and magnesium levels were significantly decreased in hyperthyroid subjects when compared to healthy controls. **Conclusion:** We conclude that, it is necessary to evaluate the serum levels of these minerals in all patients with thyroid disorders. Our study also signifies no need of supplementing magnesium of any sources. The ideal modality is to have an adequate maintenance of TSH with adequate dose of thyroid supplementation will not affect the magnesium levels.

**INTRODUCTION:**

Thyroid gland produces two important hormones called T3 and T4 under the influence of pituitary hormone TSH. Thyroid hormones play an important role in the regulation of metabolism of lipids, carbohydrates, minerals, proteins and electrolytes. Thyroid dysfunction and anatomic abnormalities of thyroid are common among the diseases of endocrine glands.<sup>2</sup>

The term hyperthyroidism is reserved for disorders that result from sustained overproduction of hormone by the thyroid gland itself. Reduced production of thyroid hormone is the central feature of the clinical state termed hypothyroidism.<sup>3</sup> Hypothyroidism is one of the most common forms of thyroid dysfunction resulting from the deficiency of thyroid hormones or from their impaired activity.<sup>4</sup> Hypothyroidism is ten times more common in women than men and its prevalence increase with age.<sup>5</sup> Mineral metabolisms like calcium, magnesium and phosphorous is frequently disturbed in thyroid dysfunctions. Thyroid hormones exert its effects on osteoblasts via nuclear receptors to stimulate osteoclastic bone resorption.<sup>6</sup> Thyroid hormones probably stimulate bone resorption directly, thereby increasing serum calcium and phosphorous concentrations and suppressing serum parathyroid hormone and 1,25-dihydroxy vitamin D3 concentrations. The decrease in these bone-resorbing hormones limits further increase in serum calcium concentration but also results in enhanced intestinal calcium absorption. In adult hypothyroidism, the opposite effects are seen.<sup>6-8</sup> Hence we have taken up this study to analyse these parameters in thyroid disorders in our population.

**OBJECTIVE OF THE STUDY:**

The objectives of the study include

1. To estimate and compare serum levels of calcium and magnesium levels in subjects with thyroid disorders (hypothyroidism and hyperthyroidism) and controls.

2. To correlate if any between serum levels of TSH and serum levels of calcium, and magnesium levels.

**MATERIALS AND METHODS:**

A case control study on evaluation of serum levels of calcium and magnesium was conducted at Shri Balaji Institute of Medical Sciences and Hospital in the Dept. of General Medicine from January 2021 to June 2021 in subjects with newly diagnosed thyroid disorders.

We included a total of 120 freshly diagnosed cases of hypothyroidism and hyperthyroidism who were attending OPD of General Medicine Dept. and 60 controls in the age group of 20-60 years both males and females. Among cases (120) subjects 60 were hypothyroid and 60 were hyperthyroid. All these subjects were diagnosed for the first time based on clinical evaluation and laboratory results of thyroid profile (TSH, T3, T4). We excluded known cases of thyroid disorders, acute infections, paediatric age group (<18yrs), elderly age group (>60yrs), renal disorders, hepatic disorders, bone disorders, diabetes, hypertension or any other systemic illness that may affect the mineral status, patients on mineral supplementation. We categorised the total subjects into three groups Group A: 60 subjects with hyperthyroidism (Increased T3 & T4 and decreased TSH), Group B: 60 subjects with hypothyroidism (decreased T3 & T4 and Increased TSH), and Group C: 60 healthy controls (Normal T3, T4 and TSH).

In all the subjects, we collected 3 mL of whole blood into plain tube and blood is allowed to clot and subjected for centrifugation, serum was separated and taken for analysis of serum calcium and magnesium levels. Serum levels of calcium and magnesium were estimated by spectrophotometric method using commercially available kits. Statistical Analysis: The data was expressed in terms of mean and standard deviation. The comparison among the groups was done using one way analysis of variance (ANOVA) and post hoc.

**RESULTS:**

We included a total of 180 subjects, out of which 60 were hyperthyroid, 60 were hypothyroid and 60 were controls.

**Table 1: Shows age wise and gender wise distribution of study subjects**

Age in years	Hypothyroid (no 60)	Hyperthyroid (no 60)	Controls (no 60)
Below 20	4	2	5
21-30	28	26	25
31-40	16	22	21
41-50	7	6	6
51-60	5	4	3

In hypothyroid group, 38 were females and 22 were males, among hyperthyroid group 32 were females and 28 were males and in healthy controls 31 were females and 29 were males.

**Table 2: Comparison of Serum Calcium and magnesium levels in cases and controls**

	Hypothyroid (no 60)	Hyperthyroid (no 60)	Controls (no 60)	P value (<0.001)
T3 (ng/mL)	0.68 ± 0.34	3.32 ± 2.43	1.14 ± 0.29	HS
T4 (µg/dL)	4.23 ± 2.21	15.67 ± 1.92	8.65 ± 2.12	HS
TSH (µIU/mL)	32.23 ± 12.32	0.16 ± 0.32	2.32 ± 1.09	HS
Serum Calcium (mg/dL)	5.98 ± 1.32	14.21 ± 1.87	8.89 ± 2.13	HS
Serum Magnesium (mg/dL)	4.82 ± 1.08	1.26 ± 0.24	2.07 ± 0.24	HS

In hypothyroid group, 38 were females and 22 were males, among hyperthyroid group 32 were females and 28 were males and in healthy controls 31 were females and 29 were males. It is evident from the above table that the levels of serum calcium were significantly decreased and magnesium levels were significantly elevated in hypothyroid subjects when compared to healthy controls and similarly serum calcium were significantly elevated and magnesium levels were significantly decreased in hyperthyroid subjects when compared to healthy controls.

We found significant negative correlation between serum TSH levels and Serum calcium levels in subjects with hypothyroidism, but we did not find any significant correlation between TSH and magnesium levels.

**DISCUSSION:**

The results of our study are in accordance with the study conducted by Murgod R and Soans G, 2012; Suneel B et al, 2011; Suneel B et al, 2012; Shivaleela MB et al 2012. Most of the studies conducted in the past have shown hypercalcemia in hyperthyroidism and hypocalcemia in hypothyroidism. In hypothyroidism, there is depressed bone turnover due to impaired mobilization of calcium in to the bone that leads to decrease in the blood calcium level. Reduced bone turnover impairs bone formation and mineralization with a subsequent risk of bone fragility and increased fracture. Associated vitamin D deficiency may be the cause for hypocalcaemia in Indian hyperthyroid patients. The underlying mechanism of hypercalcemia in hyperthyroidism is that, Hyperthyroidism is characterized by accelerated bone turnover, which is caused from direct stimulation of bone cells by high thyroid hormone concentration.

Thyroid hormones exert its effect on osteoblasts via nuclear receptors to stimulate osteoclastic bone resorption. Patients with hyperthyroidism have a significantly decreased bone

mineral density (BMD). Thus, hyperthyroidism is one of the major causes of secondary osteoporosis.<sup>8-12</sup> Magnesium is an incredibly vital mineral found in the human body. Magnesium plays an important role in a wide range of body functions. Over 300 different enzyme systems within the body rely on magnesium to function properly. Magnesium performs double-duty when it comes to this process. Not only does magnesium stimulate the thyroid gland to produce more T4, but it simultaneously changes T4 into T3. This is a huge reason why magnesium is so vital. There is also a strong correlation between magnesium and the development of goiter. Important nutrient in preventing goiter is iodine, but magnesium is right there helping too. Magnesium helps you to make more T4 in the thyroid gland. In hypothyroidism, there is hypomagnesaemia because of urinary output and fractional excretion of magnesium through urine. Magnesium level is reduced due to influence on GFR and decreased clearance. In hypothyroidism, there is an increased renal blood flow leading to high clearance of magnesium from the kidneys. Hormone and diet supplementation for magnesium showed a significant improvement which reciprocate the incidence of hypo magnesium in hypothyroidism and which is inversely proportionate to TSH levels which was not statistically significant.<sup>8-12</sup>

**CONCLUSION:**

The present study indicates the profound influence of thyroid hormone on mineral metabolism and changes in these minerals may eventually lead to complications like decreased bone mineral density and secondary osteoporosis. Therefore, it is necessary to evaluate the serum levels of these minerals in all patients with thyroid disorders. Our study also signifies no need of supplementing magnesium of any sources. The ideal modality is to have an adequate maintenance of TSH with adequate dose of thyroid supplementation will not affect the magnesium levels.

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