

# Study on Serum Calcium levels in subclinical hypothyroidism among patients attending Jorhat Medical College:A hospital based study

KEYWORDS	calcium, subclinical hypothyroidism, thyroid stimulating hormone(TSH)			
Dr.Reetv	vik Kumar Dutta	Dr.Saurabh Borkotoki		
Post Graduate Trainee, Department of Biochemistry,		Professor and Head, Department of Biochemistry,		
Iorhat Medica	al College.Iorhat-785001.	Iorhat Medical College. Jorhat-785001.		

**ABSTRACT** Introduction: Thyroid stimulating hormone (TSH) of the anterior pituitary controls synthesis and secretion of thyroid hormones- thyroxine (T4) and triiodothyronine(T3). Thyroid hormone stimulates almost all aspects of bio-molecular metabolism, affects basal metabolic rate and plays critical roles in maintaining metabolic homeostasis. Thus thyroid dysfunction seems to be associated with derranged mineral metabolism. Subclinical hypothyroidism is a condition in which TSH is elevated indicating lowered thyroid activity, but free T4 is normal. Assam belongs to the sub Himalayan Goiter belt, thus a prevalent region of thyroid dysfunction and therefore, by estimating serum calcium in cases of high TSH with no clinical symptoms, the study attempts to evaluate the findings critically.

## Aims and Objective:

- To determine serum Calcium in subclinical hypothyroid cases
- · To analyse the values of serum Calcium and compare the findings with other studies
- Materials and methods:

Type of study: case control study (40 cases and 40 controls).

*Place of Study*-Department of Biochemistry, Jorhat Medical College Hospital *Laboratory investigations*:

- Serum calcium estimated in Vitros 250 dry chemistry autoanalyser
- Serum TSH, T3 and T4 estimated in Access Immuno Assay Systems (Beckman Coulter)

Statistical analysis: Statistical analysis and significance was carried out using Microsoft Excel and online calculator.

**Results:** Mean values of TSH, Serum calcium cases was  $11.65\pm1.35(\mu IU/mL)$  and  $7.13\pm0.36$  (mg/dL) in cases of subclinical hypothyroidism. Serum calcium showed a negative (r = -0.645) Pearson coefficient value with serum TSH in the cases.

**Conclusion:** Serum calcium decreases with increase in the amount of TSH, thus implies weightage of routine serum calcium estimation in a thyroid dysfunction patient.

# Introduction:

Electrolytes play a key role in many body processes, such as controlling fluid levels, acid-base balance (pH), nerve conduction, blood clotting and muscle contraction [1]. Thyroid disease is common in the general population and the prevalence increases with age. In India, 42 million people are suffering from thyroid diseases; hypothyroidism being the commonest thyroid disorder [2]

Haemodynamic balance, thermoregulation and metabolism of the body is centrally regulated by thyroid hormone. Thyroid hormones(TSH,T3,T4) perform various metabolic functions ranging from regulation of lipid, carbohydrate, protein to electrolyte and mineral metabolisms. The effect and the underlying mechanisms of action of thyroid hormones on electrolytes and minerals has not been well established and understood, although its effect on lipid metabolism is well known [3]. Normal growth and maturation of skeletal system is essentially dependent on thyroid hormones . Disturbances of calcium homeostasis is frequently associated with thyroid dysfunction. Thyroid disorders are important in the aetiology of secondary osteoporosis [4]. Few studies show normal serum calcium levels[5], while others show decreased levels of it in hypothyroidism [6]. Even though the changes in the serum calcium may be slight in thyroid disorders, these disturbances will be important for patient over a long duration [7]. There is a depressed turnover due to impaired mobilization of calcium into the bone, in hypothyroidism, that leads to decrease in blood calcium level. In hyperthyroidism there is poor mobilization of calcium that leads to increased the blood calcium level. In hypothyroidism increased production of thyroid calcitonin also favors the tubular excretion of calcium .In hyperthyroidism decreased production of thyroid calcitonin can promote the tubular excretion of phosphate and also favors the tubular absorption of calcium [8]. Hypokalaemia and other mineral abnormalities are seen in patients with thyrotoxicosis [9].Subclinical hypothyroidism refers to cases having increased

serum TSH levels without evident sign and symptoms of hypothyroidism.

Jorhat Medical College is a referral centre for the patients of the Brahmaputra valley, of Majuli ,the largest river Island and of the surrounding districts like Sibsagar, Gologhat and Jorhat itself. So, we found good number of patient with subclinical hypothyroidism visiting the OPD's of JMCH, Jorhat. Though calcium level is significantly associated with the degree and severity of the hypothyroidism, but no study has been done on this subject yet at JMCH, Jorhat .Thus the present study was undertaken to assess the alterations in the levels of serum calcium in subclinical hypothyroidism & euthyroid controls.

#### Materials and methods:

The study was conducted in Jorhat Medical college and Hospital. 40 patients having subclinical hypothyroidism with age group of 12 years or older of both male & female sex was be selected consecutively from the population coming to the Outdoor or Indoor in the Medicine department during this study period. Equal numbers of healthy individuals with matched age and sex was selected as control.

## Inclusion criteria for cases:

Subclinical hypothyroid patients (Serum TSH level > 5.5  $\mu$ IU/mL without prominent sign and symptoms of hypothyroidism)

#### The exclusion criteria in this study:

- Patients with thyroid cancer
- Patients with Post thyroidectomy
- $\bullet \quad {\rm Age\,less\,than\,12\,years}$
- Patients on chemotherapy for any malignancy
- Patients with history of intake of thyroid drugs, hypertension, diabetes mellitus and obesity

## Study Time:

Between March 2016 and November 2016.

### Specimen collection for tests:

Collected 2cc of venous blood in sterile empty vial from each of the study subjects maintaining all routine precautions.

Allowed the samples to clot and serum was separated.

Then serum was shifted to storage tubes and was tested within four hours of collection at room temperature.

Haemolysed samples were discarded.

#### Estimation:

Estimation of Serum TSH,T3,T4 was carried out in Access Immuno Assay Systems (Beckman Coulter) and Serum Calcium was estimated in Vitros 250 dry chemistry autoanalyser at the clinical Biochemistry wing of Central Clinical Laboratory, Jorhat Medical College Hospital

#### Assays

- :The Access TSH assay is a two site immunoenzymatic ("Sandwich") assay.
- The Access T3,T4 assay are competitive binding immuno enzymatic assay.
- The VITROS Ca Slide method is performed using the VITROS Ca Slides and the VITROS Chemistry Products Calibrator Kit 1 on VITROS 250

#### Calibration:

Regular calibrations were done.

#### Quality control:

QC material simulate the characteristics of patient samples are commercially available and supplied by the manufacturers-Beckman Coulter and Vitros 250 were used.

Quality control materials were run in every 24 hours time for authenticity of the reports.

These QC materials cover at least two levels of the analyte. The test results were accepted only when quality control results were found to be within acceptable ranges.

## Statistical analysis:

Statistical analysis and significance was carried out using Microsoft Excel and online calculator.

## **Results:**

In our study the values of Serum T3,T4, TSH and serum Calcium were 1.15 $\pm$ 0.14 ng/mL, 7.59 $\pm$ 1.13 µg/dL, 1.63 $\pm$ 1.14 µIU/mL and 9.3 $\pm$ 0.49 mg/dL respectively in the control group. In the case group, the values of Serum T3,T4, TSH and serum Calcium were 0.97 $\pm$ 0.15 ng/mL, 6.96 $\pm$ 0.87 µg/dL, 11.65 $\pm$ 1.35 µIU/mL and 7.13 $\pm$ 0.36 mg/dL respectively

Table	1:	Comparison	of	Serum	T3(ng/m	ıL),T4(μg	g/dL),
TSH(µl	IU/ı	mL) and Calciu	<b>m (</b> 1	mg/dL) iı	a caseand	control gro	oup

Tests	Controls	Cases	P value
T3(triiodothyronine)	$1.15 \pm 0.14$	0.97±0.15	<0.05
T4(thyroxine)	7.59±1.13	6.96±0.87	<0.01
TSH(thyroid stimulating hormone)	1.63±1.14	11.65±1.35	<0.001
Calcium	9.3±0.49	7.13±0.36	<0.05

The Pearson correlation coefficient between Serum TSH and serum Calcium in subclinical hypothyroid cases was found to -0.645

Table 2: Pearson correlation coefficient between Serum TSH and Serum Calcium in subclinical hypothyroid cases

	r value
Serum TSH	-0.645
Serum Calcium	

#### **Discussion:**

In our study there was significant decrease in serum calcium levels in Subclinical hypothyroid cases than the matched controls (p<0.05). Shivallela *et al*[6] demonstrated a significant decrease in serum calcium of Subclinical hypothyroid group than control. This is mainly due to the low levels of Parathyroid hormone and low levels of calcitonin in hypothyroidism. Animal study done by Kumar and Prasad concludes that renal calcium excretion was increased in rats with high TSH levels, leading to low blood calcium levels [10].

Murgod R and Soans G 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 [12].

We also correlated the levels of serum calcium with Thyroid Stimulating Hormone. In case of subclinical hypothyroidism, serum calcium were negatively correlated with TSH . Schwarza C *et al* and Ashmaik AS *et al* also found a significant correlation of serum calcium with TSH, T3 and T4 [9,11]. Morgood R *et al* showed significant negative correlation between TSH, serum calcium in hypothyroidism [12]Gammage reported negative correlation of serum calcium with TSH [13]. Our study findings are also comparable with studies of Abdelgayoum A[14] and Bharti A et al[15].

#### **Conclusion:**

This study concludes that serum calcium levels was decreased in subclinical hypothyroidism compared to euthyroids. Early detection and treatment can prevent the further complications related to the disorder and will be helpful during the management of thyroid patients, as we found a good number of subclinical hypothyroid case while testing serum TSH. Further elaborative study regarding role of supplementation of calcium in such cases to prevent further progress of the condition, in near future is highly advocated.

#### **References:**

- Rao GM. Serum electrolytes and osmolality in diabetes mellitus. Indian J Med Sci. 1992;46(10):301-303.
- Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective. Indian J Endocrinol Metab. 2011; 15:78-81 Mariani LH, Berns JS. The renal manifestations of thrvoid disease. J Am Soc Nephrol. 2012; 23(1):22–26.
- Mariani LH, Berns JS. The renal manifestations of thyroid disease. J Am Soc Nephrol 2012;23(1):22–26
- Sato K, Han DC, Fujii Y, Tsushima T, Shizume K. Thyroid hormone stimulates alkaline phosphatase activity in cultured rat osteoblastic cells through triiodo thyronine nuclear receptors. Endocrinology.1987;120(5):1873-81.
  Sabuncu T, Aksoy N, Arikan E, Ugur B, Tasan E, Hatemi H. Early changes in the
- Sabuncu T, Aksoy N, Arikan E, Ugur B, Tasan E, Hatemi H. Early changes in the parameters of bone and mineral metabolism during therapy for hyperthyroidism and hypothyroidism. Endocrine Research. 2001;27(1-2):201-13.
- Shivallela MB, Poornima RT and Jayaprakash Murthy DS. Serum calcium and phosphorous levels in thyroid dysfunction. Indian journal of fundamental and applied life science .2012; 2(2):179-83.
- Ford HC, Crooke MJ, Murphy CE. Disturbances of calcium and magnesium metabolism ocurs in most hyperthyroid patients. Clin Biochem. 1989; 22:373-6.
- Melmed S, Polonsky KS, Larsen PR, Kronenberg HM. William's text book of endocrinology. Calcium and phosphorus metabolism in hypothyroidism. 12th ed. 2011;10-11.
- 9. Schwarza C, Leichtle AB, Spiros A, George MF, Heins Z, Aristmenis K, Gregor L. Thyroid function and serum electrolytes. Swiss Medical Weekly. 2012; 13669 142.
- Kumar V, Prasad R. Molecular basis of renal handling of calcium in response to thyroid hormone status of rat. Biochem Biophys Acta. 2002; 1586(3):331-43.
  Ashmaik AS, Gabra HM, Elzein AO, Nassr Eldin MA, Hassan EE. Assessment of Serum
- Assimilar AS, Oaufa HW, Ezzem AO, Nassi Exturn Ari, Hassan Externation and Phosphorous in Sudamese Patients with Hypothyroidism. Asian Journal of Biomedical and Pharmaceutical Sciences. 2013; 3(25):21-26.
- Murgod R, Soans G. Changes in Electrolyte and Lipid profile in Hypothyroidism. International Journal of Life science and Pharma research. 2012;2(3): 185-194.
  Gammage MD, Logan SD. Effects of thyroid dysfunction on serum calcium in the rat.
- Gammage MD, Logan SD. Effects of thyroid dysfunction on serum calcium in the rat. Clinical Science. 1986;71(3):271-76.
  Abdefaruum A. Purlinidentia and can minoral profiles in patients with thyroid
- Abdelgayoum A. Dyslipidemia and serum mineral profiles in patients with thyroid disorders.Saudi Med J.2014; Vol.35 (12):1469-1476
  Bharti A Shrestha S. Bai B, et al. Assessment of serum minerals and electrolytes in
- Bharti A,Shrestha S,Rai R et al. Assessment of serum minerals and electrolytes in thyroid patients. International Journal of Advances in Scientific Research. 2015; 1(06): 259-263.