

MINERAL METABOLISM IN HYPER THYROIDISM

SUNEEL.B^{1*}, J.N.NAIDU¹ AND APARNA.R.R.¹

¹Department of Biochemistry, Narayana Medical College, Nellore, India



SUNEEL.B

¹Department of Biochemistry, Narayana Medical College, Nellore, India

ABSTRACT

Thyroid hormones influences the metabolism of all the substrates including minerals. A patient with thyroid dysfunction may also manifests the symptoms that are consequent upon the altered mineral levels. The study shows that hyper thyroidism increases the Ca^{++} level decreased by bone turn over. In hyperthyroidism increased tubular re absorption of Po_4^- affecting GFR, low clearance of Po_4^- . Hyperthyroidism decreased renal blood flow will be leading to low clearance of Mg^{2+} & Zn^+ from kidney. So low tubular excretion of Mg^{2+} & Zn^+ will be prominent at plasma levels. The study was conducted over a period of six months. In this study, 30 subjects hyperthyroidism with euthyroidism were selected. Both males and females were included. Blood samples were collected for estimation of TSH, FT3, FT4, serum Ca, serum Po_4^- , serum Mg^{2+} & serum Zn^+ . In Hyperthyroid patients, the serum levels of minerals Ca^+ , Zn^+ , Mg^{2+} ($p < 0.001$) were significantly increased and PO_4 ($p < 0.001$) levels were significantly decreased compared to controls. Mineral status is observed in all the patients Ca^+ levels are high because decreases bone turnover abating phosphorus levels negative influences on paratharmone and calcitonine, Zn^+ & Mg^{2+} levels reflects the influences on GFR and increased clearance of these minerals

KEYWORDS

Thyroid stimulating hormone Zinc , Calcium, Magnesium , Glomeruli Filtration Rate.

INTRODUCTION

Thyroid gland produces T_3 & T_4 . These hormones play a critical role in cell differentiation during development and help to maintain thermogenic , mineral, metabolic homeostasis in the adult.

Hyper thyroidism: abnormal activity of thyroid gland that leads mental and physical slowing because of increase in the basal metabolic rate.⁴

The mean annual incidence rate of hyperthyroidism is upto 4 per 1000 women, 1 per 1000 men, 1 in 4000 inborns. The prevalence of overt hypothyroidism increase with age⁶.

Thyroid hormone is essential for normal growth and maturation of the skeleton^{1, 2}.

Abnormal of thyroid hormone enhances the early life leading to both delay in the development of bone and stippled appearance of epiphysial centers of ossification, which results possible dwarfism. In hypothyroidism, there is a depressed turnover due to impaired mobilization of calcium into the bone that leads to decrease in the blood calcium level⁷. In hyperthyroidism, there is poor mobilization of calcium that leads to increases the blood calcium level.

In hyperthyroidism decreased production of thyroid calcitonine⁷. Can promotes the tubular excretion of phosphate and also favors the tubular absorption of calcium².

Adults contain about 20 gr of Mg^{++} 70% of which is found in bones¹⁴. In hyper thyroidism there is hyper magnesemia because of lower clearance of magnesium from renal tubules.^{4,11}

Zinc is a intracellular element it can influences the development and normal growth of tissues. Zinc is involved the process that converts active of thyroid hormone in hyper thyroidism T_4 is not converts to active hormone T_3 and increases the metabolic rate. In hyperthyroidism the tubular excretion of zinc is low.increases the plasma zinc levels

The treatment modalities can also be framed while treating a hyperthyroidism patients keeping in view of the altered mineral metabolism^{11,12}.

The present study was conducted to find out the status of minerals Ca^{++} , Zn^{++} , Mg^{2+} and PO_4 in hyperthyroidism

MATERIALS AND METHODS

The study was conducted over a period of 6 months in Narayana Medical College & Hospital. In this study, we have included diagnosed 30 hyper thyroidism people as subjects & 25 numbers of healthy people having normal thyroid levels as controls.

Serum TSH^{19,20}, FT3^{15,16}, FT4¹⁷ were estimated by ELISA.

Serum Ca^{++} level was estimated by OCP method (O-cresolphthalein Complexone Method)^{21,22}.

Serum PO_4 level was estimated by Ammonium hepto molibdate method (Mod,Gomorri's Method)^{23,24}.

Serum Mg^{2+} level was estimated by GEDTA method (Glycoletherdiamine – N,N,N',N'-tetra acitic acid)²⁵.

Serum Zn^{++} level was estimated by Nitro-PAPS method (Phosphor adenosyl phosphor sulfate method).^{26,27}

RESULTS

The values obtained on analyzing specimens collected from patients and control groups are tabulated.

The mean values and standard deviation also have been calculated for comparative study of patients and controls.

The values of patients and control groups are also graphically represented for comparison at a glance . The graphs were plotted using mean values of all the study parameters.

Table 1 shows mean ,standard deviation and p values of all the study parameters in hyper thyroid people and control subjects.

p value < 0.001 was considered significant. PO₄ levels were significantly (<0.001)

decreased . Ca⁺⁺, Mg²⁺, Zn⁺⁺ , were significantly (<0.001) increased.

compared to controls the TSH levels (0.0001) also significantly decreased in cases and FT₃, FT₄ levels (<0.008) significantly increased

FIGURE 1:

Correlation of FT3,FT4 & TSH mean values between patients and controls.

The graph shows Significant decreases of TSH levels in subjects were observed compared to the controls . Increases FT3 & FT4 in subjects. It indicates the hyperthyroidism.

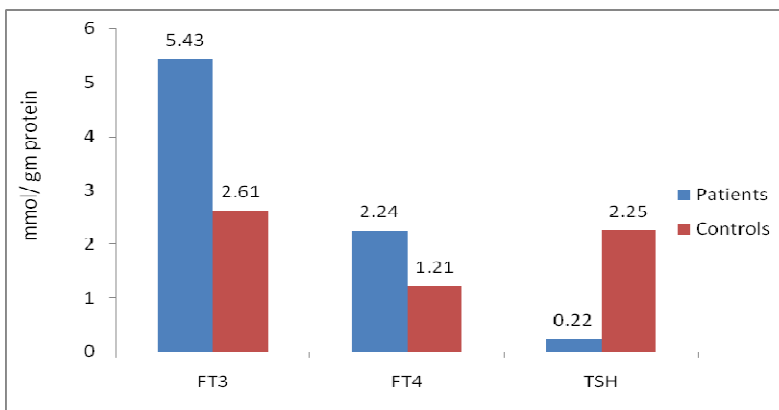


FIGURE - 1

Comparison of FT3,FT4 and TSH levels in hyperthyroidism patients with controls.

FIGURE 2:

Evaluation of Ca⁺⁺, PO₄⁻, Mg²⁺ & Zn⁺⁺ mean values between patients and controls.

The graph shows Significant decreases of Po₄⁻ levels in subjects were observed compared to the controls . Increased Ca⁺⁺, Mg²⁺ & Zn⁺⁺ levels in hyperthyroidism subjects compared to controls.

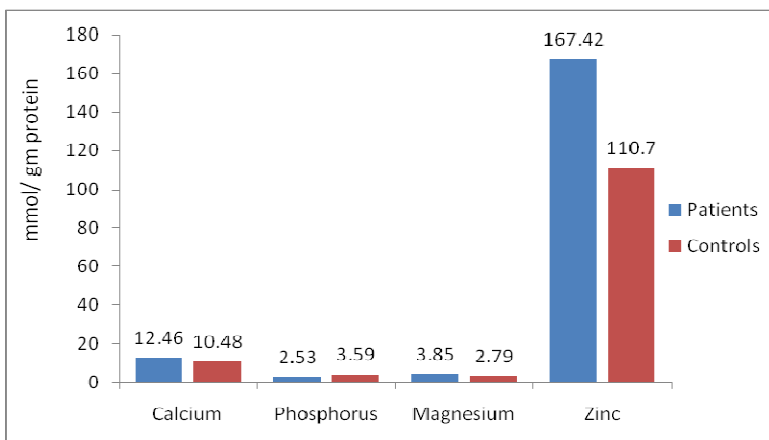


FIGURE- 2

Comparison of Ca⁺⁺, PO₄⁻,Mg²⁺ and Zn⁺⁺ levels in hyperthyroidism patients with controls

Table 1 shows mean ,standard deviation and p values of all the study parameters in thyroid people and control subjects.

TABLE: 1
COMPARITIVE STUDY OF HYPER THYROID PATIENTS WITH CONTROLS

Sl.no	parameter	patients		controls		P'value
		Mean	S.D	mean	S.D	
1	FT3	5.43	5.42	2.61	0.73	0.001
2	FT4	2.24	1.95	1.21	0.42	0.001
3	TSH	0.22	1.25	2.25	1.25	0.001
4	Calcium	12.46	2.38	10.48	1.40	0.002
5	Phosphorus	2.53	1.03	3.59	0.99	0.001
6	Magnesium	3.85	1.46	2.79	0.98	0.001
7	Zinc	167.42	34.58	110.70	14.50	0.001

DISCUSSION

The present study was conducted to find out the status of minerals (ca⁺ ,mg²⁺ ,p and zn) in thyroid disorder.

Present study suggests hyper calcemia can be seen in hyperthyroidism.

Previous studies also revealed that hyper calcemia is seen in hyperthyroidism; this is mainly due to the high levels of PTH and high levels of calcitriol.

In hyperthyroidism, calcitonin regulates the over tubular excretion of PO₄ from kidney , which is conditioned by the PO₄ levels that are raised due to compensatory effect of calcitonin and paratharmone which favour tubular reabsorption (by inhibiting tubular re absorption), high levels of calcium found quite often⁴.

In hyperthyroidism, there is a decreased renal blood flow leading to low clearance of magnesium from the kidneys. So, high levels of magnesium will be causing hyper magnesemia^{12,14}.

Abnormal zinc metabolism occurs commonly in thyroid disease.

In hyper thyroidism, there is a low renal blood flow and decreased clearance of zinc is observed, leading high levels of zinc causing higher zinc values.

In hyperthyroidism due to high intestinal motility facilitates to rapid absorption of zinc which leads to elevated plasma zinc levels.

Based on the findings of the study, it is inferred that mineral metabolism is intimately associated with thyroid hormone.

Thyroid hormone determines the mineral pool in the blood by influencing mobilization of minerals like calcium and phosphorus, in to the blood and also by influencing their clearance through urinary excretion due to its effect on GFR or renal plasma flow.

High levels of calcium in hyperthyroid cases reflect prominent metabolism of calcium. This was evident in 65% of the total number of hyperthyroid cases.

High levels of magnesium and zinc reflect influence of thyroid hormone on GFR and there by clearance of these minerals by filtration. Accordingly high levels were observed in hyperthyroid cases.

All above findings with regard to mineral metabolism indicate the profound influence of thyroid hormone by affecting either mobilization or clearance from the blood or in to the blood.

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