

# Evaluation of Alteration of Serum Uric Acid Level in Hypothyroid and Hyperthyroid Patients in a Tertiary Care Hospital

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**Abstract:** It has been demonstrated by several studies that thyroid function can affect almost all metabolic activity. Both hypo and hyperthyroidism have potentially fatal systemic manifestations. Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones which, in turn, results in a generalized slowing down of all metabolic processes. Hypothyroidism is associated with many biochemical abnormalities including increased uric acid levels. Reason behind hyperuricaemia in patients with hyperthyroid status, who are expected to have a higher renal clearance of uric acid may be the increased uric acid production secondary to increased overall metabolism in hyperthyroid patients. According to null hypothesis there is no significant relationship between thyroid status and uric acid level. Justification of this present hospital based non interventional case control study was designed to find any association between uric acid level with hypothyroidism and hyperthyroidism in comparison to normal control. In our study we find that 50 patients of primary hypothyroidism also suffers from hyperuricemia whereas there is also significantly high uric acid level found in primary 31 primary hyperthyroid patients in comparison to euthyroid population.

**Keywords:** Hypothyroid, Hyperthyroid, Euthyroid, Hyperuricemia

## 1. Introduction

It was asserted by various studies that hypothyroidism is associated with many biochemical abnormalities including increased uric acid levels.<sup>1</sup> Probable reason behind hyperuricaemia in patients with hyperthyroid status, who are expected to have a higher renal clearance of uric acid may be the increased uric acid production secondary to increased overall metabolism in hyperthyroid patients surpassing uric acid diuresis caused by hyperthyroidism.<sup>2</sup> Studies done in different countries also demonstrated weak or no significant relations between uric acid level and thyroid hormone status. In our present study we tried to find out the association of uric acid level in both hypothyroid and hyperthyroid individuals provided that renal function tests are normal in a tertiary care hospital in West Bengal. Very few studies are done in this region so result of our study would emphasize the need for evaluation of serum uric acid levels in altered thyroid hormone status.

## 2. Materials and method

In the present study all the blood samples were collected in OPD clinical biochemistry laboratory of College of Medicine and Sagore Dutta Hospital. Permission for this study was taken from Institutional Ethics committee. Newly diagnosed case of hypothyroidism and hyperthyroidism in the age group 20-60 year, both male and female before introduction of any kind of thyroid medications were taken as cases after obtaining informed consent. Age and Sex matched control cases were taken. All participants were categorized by their thyroid stimulating hormone (TSH) levels as having euthyroid (TSH 0.35–6 mIU/mL) or control, hypothyroid (TSH >6 mIU/mL) and hyperthyroid (TSH, 0.35 mIU/mL) status. Hyperuricaemia was defined as a serum uric acid level above 6.6 mg/dL in men or above 5.5 mg/dL in Women. Detailed clinical history was taken to exclude any chronic illness like DM, hypertension, CRF, Secondary

hypo/hyperthyroidism, any substance abuse, chronic alcoholic, any drug intake that affect renal and liver function, Chronic inflammatory disease. Experiment design taken was non interventional, hospital based case control study. Serum TSH and total T4 by ELISA method. Serum urea, creatinine and uric acid were measured by autoanalyzer EM360 to exclude any renal compromise. Statistical analysis was performed by Q software after obtaining data at the end of study. Mean, Standard deviation was calculated for both cases and control population. Student's T test was calculated to detect any significance difference between case and control. A two-sided p value <0.05 was considered statistically significant.

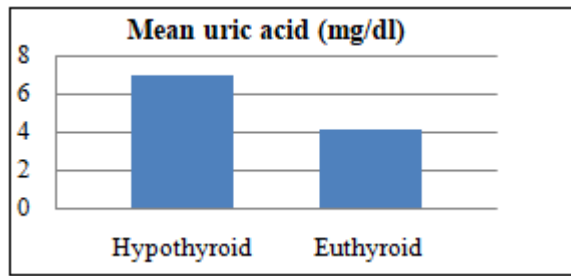
## 3. Result

Table 1 shows mean serum TSH, total T4 and serum uric acid level in euthyroid, hypothyroid and hyperthyroid population. It was evident from table 1 that mean serum uric acid levels in both the cases are higher than control population.

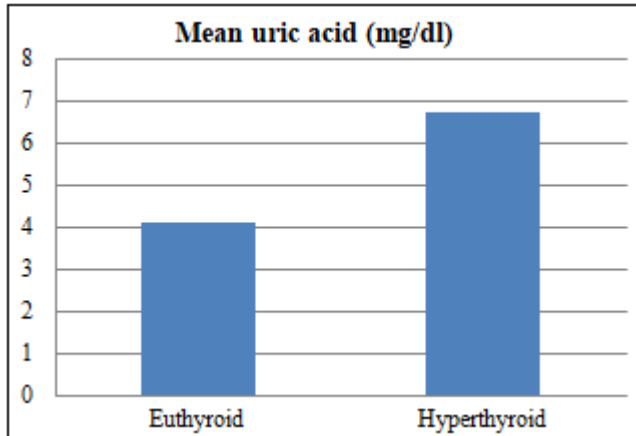
**Table 1:** Mean serum TSH, total T4 and serum uric acid level in euthyroid, hypothyroid and hyperthyroid

	Euthyroid	Hypothyroid	Hyperthyroid
Serum TSH (mean)	2.21 mIU/ml	15.16 mIU/ml	0.20 mIU/ml
Serum total T4 (mean)	10.1 mIU/ml	2.12 mIU/ml	15.5 mIU/ml
Serum uric acid (mean)	4.1 mg/dl	6.9 mg/dl	6.7 mg/dl

Student's T test was calculated to detect any significance difference between case and control which shows **that two-tailed P value for hypothyroid and euthyroid uric acid s equals 0.0011. By conventional criteria, this difference is considered to be very statistically significant.** In case of hyperthyroid and euthyroid uric acid Student's T test also appears significant with a p value <0.005.



**Diagram 2:** Mean uric acid level in Euthyroid and hypothyroid population



**Diagram 3:** Mean uric acid levels in euthyroid and hyperthyroid population.

#### 4. Discussion

Thyroid hormone dysfunction can affect almost all metabolic activities including purine nucleotide metabolism. Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones which, in turn results in a generalized slowing down of metabolic processes on the other hand hyperthyroidism is a hyper metabolic state. Association between hypothyroidism and hyperthyroidism with hyperuricemia was demonstrated by numerous studies. In our present study we found that hypothyroidism is associated with hyperuricemia. In comparison to the prevalence reported in the general population, a significant increase of both hyperuricemia and gout was found in the hypothyroid patients. In hypothyroidism the hyperuricemia is secondary to a decreased renal plasma flow and impaired glomerular filtration. Giordano et al. conducted a study among 28 patients with primary hypothyroidism and showed 33.3% prevalence of hyperuricemia in patients with hypothyroidism. In our study we also found significantly high uric acid level in both hypothyroid and hyperthyroid patients.<sup>3</sup> The association between hypothyroidism and hyperuricemia was first suggested in 1955 by Kuzell and colleague, who examined 520 patients suffering from gout and found hypothyroidism in 20% of the males and in 30% of the females.<sup>4</sup>

On the contrary, the association between hyperthyroidism and hyperuricemia has always been more controversial. In 1989 Ford *et al*<sup>5</sup> in contrast with previous reports<sup>6</sup>,<sup>7</sup> demonstrated that hyperthyroidism can cause hyperuricemia through the increase of purine nucleotide turnover and the decrease of renal urate excretion.

According to Lai-Chu See et al the prevalence of hyperuricemia was higher in hyperthyroid subjects (19.4%) than in euthyroid subjects (17.8%) but not in hypothyroid subjects (19.3%).<sup>8</sup> In a study on 12 induced hypothyroid rabbits, mean serum uric acid level was found higher in hypothyroid condition than in euthyroid condition<sup>9</sup>. In an epidemiological study in northern Finland in 1969, hyperuricemia was found in rural, urban and hospital admitted hypothyroid patients<sup>10</sup>. In a case-control study done in the Biochemistry Department of Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh serum uric acid level has been found significantly higher in cases compared to controls.<sup>11</sup> According to a study done by Jia D et al. hypothyroidism patients had significantly higher levels of TSH than those in the control groups.<sup>12</sup>

#### 5. Conclusion

According to various studies a significant correlation between thyroid function and purine nucleotide metabolism has been established in hypothyroidism. On the contrary, the relationship between hyperthyroidism and purine metabolism is more controversial. In conclusion we found a significant association between thyroid status and hyperuricemia, both hypothyroid and hyperthyroid statuses were associated with a higher risk of hyperuricemia than euthyroid control population provided renal function tests are within normal limit. Our present study thus emphasizes necessity of evaluation of uric acid level in both hypothyroid and hyperthyroid individual.

#### 6. Declaration

- The manuscript is being submitted by Corresponding author on behalf of all the authors.
- There is no conflict of interest.
- The manuscript is original work of all authors.
- All authors made a significant contribution to this study.
- All authors have read and approved the final version of the manuscript.

#### References

- [1] Greenspan FS. The thyroid gland. In: Greenspan FS & Gardner DG (eds). Basic & Clinical Endocrinology. 7th edn. New York: The McGraw-Hill Companies, 2004: 215-294.
- [2] Sato A, Shiota T, Shinoda T, Komiya I, Aizawa T, et al. (1995) Hyperuricemia in patients with hyperthyroidism due to Graves' disease. *Metabolism* 44: 207-211.
- [3] Giordano N, Santacroce C, Mattii G, Geraci S, Amendola A, Gennari C. Hyperuricemia and gout in thyroid endocrine disorder. *Clin Exp Rheumatol*. 2001; 19: 661-665.
- [4] Kuzell Wc, Schaf Farzick Rw, Naugler We *et al.*: Some observations on 520 gouty patients. *J Chronic Dis* 1955; 2: 64-8.
- [5] Ford Hc, Lim Wc, Chisnall Wn, Pearce Jm: Renal function and electrolyte levels in hyperthyroidism: urinary protein excretion and the plasma concentrations of urea, creatinine, uric acid, hydrogen

- ion and electrolytes. *Clin Endocrinol* 1989; 30: 293-301.
- [6] Yo Kogoshi Y, Saito S: Abnormal serum uric acid level in endocrine disorders. *NipponRinsho* 1996; 54: 3360-3.
- [7] SMYTH CJ: Disorders associated with hyperuricemia. *Arthritis Rheum* 1975; 18: 713-9
- [8] Lai-Chu See, Chang-Fu Kuo, Kuang-Hui Yu\*, Shue-Fen Luo, I-Jun Chou, Yu-Shien Ko, Meng-Jiun Chiou, Jia-Rou Liu. Hyperthyroid and Hypothyroid Status was strongly associated with Gout and weakly associated with hyperuricaemia.
- [9] Dariyerli N, Andican G, Catakoglu AB, Hatemi H, Burcak G. Hyperuricemia in hypothyroidism: is it associated with post-insulin infusion glycemic response? *Tohoku J Exp Med* 2003; 199: 59-68.
- [10] Isomaki H. Hyperuricemia in northern Finland. An epidemiological study of serum uric acid in rural, urban and hospital populations. *Ann Clin Res.*1969; 1(Suppl 1): 1-62.
- [11] A Haque Khan1, I Majumder Serum Creatinine and Uric Acid Levels of Hypothyroid Patients. *Bangladesh J Med Biochem* 2010; 3(2): 61-63
- [12] Jia D, Liang LB, Tang GH, He H, Zhang M, Li ZP, Li SQ.The Association Between Serum Uric Acid and Creatinine in Patients with Hypothyroidism. *Sichuan Da Xue Xue Bao Yi Xue Ban.* 2015 Sep;46(5):747-

