



## STUDY OF URIC ACID LEVELS IN PATIENTS WITH HYPOTHYROIDISM AND ITS CORRELATION WITH SERUM THYROID STIMULATION HORMONE LEVELS

**Yogananda M N**

Assistant Professor, Department of general medicine, Bangalore Medical college and research institute

**Siddesh N**

Senior resident, Department of general medicine, Bangalore medical college and research institute

**Ashokavardhana S\***

Postgraduate, Department of general medicine, Bangalore medical college and research institute \*Corresponding Author

### ABSTRACT

**Aim:** we aimed to investigate whether there is a correlation between uric acid levels and TSH levels in the patients with hypothyroidism. **Material and method:** This observational cross-sectional study was conducted on patients attending OPD/ IPD of Hospitals affiliated to Bangalore Medical College and Research Institute, Bangalore from November 2019 to May 2021. Data of all the patients satisfying the inclusion and exclusion criteria was collected. Data was analyzed by descriptive statistics. Pearson correlational analysis/Spearman's rank correlation was used to assess the correlation between Uric acid and TSH levels. **Results:** A total of 90 cases were taken up for the study. The mean age of the subjects was found to be  $32 \pm 8$  years, 82(91%) were females and only 8(9%) were males. The average height of the subjects was  $158.67 \pm 9.31$  cm. The average weight was  $63.94 \pm 9.72$  kg. The mean pulse rate of the subjects was  $75.62 \pm 5.66$ , mean RR was  $18.63 \pm 1.83$ , mean BP was  $111 \pm 7/75 \pm 5$ . The average T3 was observed to be  $1.59 \pm 0.96$ , average T4 was  $3.83 \pm 3.73$  and average TSH was  $30.89 \pm 20.93$ . The mean serum uric acid of the subjects was  $6.3 \pm 1.28$  mg/dl, mean serum creatinine was  $0.87 \pm 0.15$  mg/dl and mean eGFR was  $85.44 \pm 16.45$ , mean HB was  $11.58 \pm 1.69$ , MCV was  $79.81 \pm 6.76$ . Platelet count was  $2.92 \pm 1.35$ . The average Ferritin was found to be  $185.21 \pm 359.03$ . The average LDH was  $296.46 \pm 106.35$ , microcytic hypochromic anemia was present in 21(23%) subjects and normocytic normochromic anemia was present in 69(77%) subjects. Pearson correlation analysis showed that there was positive association between TSH and serum uric acid, among the subjects. However, the association was not found to be statistically significant as  $p > 0.05$ . **Conclusion:** Although not statistically significant, a positive correlation was observed between the uric acid and thyroid stimulating hormone.

**KEYWORDS :** Hypothyroidism, Thyroid Stimulating Hormone, Serum Uric acid.

### INTRODUCTION

Hypothyroidism is defined as a condition with decrease in thyroid hormone production as a result of a defect in any part of the hypothalamic-pituitary-thyroid axis. As a laboratory finding, high TSH, low T4 and T3 are detected. Subclinical hypothyroidism is a common endocrine disorder characterized by normal T3, T4 level, increased TSH level, usually without clinical manifestations.(1) It can cause a number of symptoms, such as the poor ability to tolerate cold, a feeling of tiredness, constipation, slow heart rate, depression and weight gain. Occasionally there may be swelling of the front part of the neck due to goiter.(2) Untreated cases of hypothyroidism during pregnancy can lead to delays in growth and intellectual development in the baby or congenital iodine deficiency syndrome.(3)

The kidneys play a role in the metabolism and elimination of thyroid hormones, at the same time the kidneys are organs where the effects of thyroid hormones are present. The effects of hypothyroidism on the kidney are well understood and are associated with water and electrolyte balance and tubular dysfunction.(4,5) How renal routine biochemical markers change in hypothyroidism is not well characterized, and changes in urea and creatinine levels are not mentioned in standard reference texts.(6,7) In uncomplicated primary hypothyroidism, urea and creatinine levels increase reversibly in children and adults.(8-11) In some studies, hyperuricemia and thus a predisposition to gout were found in hypothyroid patients.(12) Studies and data on renal functions in hypothyroidism are limited.(10,11) The relationship between kidney and thyroid functions has been known for years.(13,14) Thyroid hormones are necessary for the development of the kidney and for maintaining the water and electrolyte balance. In addition, the kidney plays a role in the metabolism and elimination of thyroid hormones. In clinical practice, hypo- and hyperthyroidism is effective in electrolyte and fluid metabolism and also in cardiovascular

functions.(7,8) Impairment in kidney functions may lead to changes in the synthesis, secretion and elimination of thyroid hormones.(14) The most common renal dysfunction in hypothyroid patients is increased serum creatinine level, decreased glomerular filtration rate (GFR) and renal blood flow, impaired free water excretion, and hyponatremia.(5) Our aim in this study was to determine whether uric acid levels are associated with TSH levels in hypothyroid patients. Although the increase in urea and creatinine values in hypothyroidism is not mentioned in the reference texts, there are many publications showing the increase in urea and creatinine values in uncomplicated hypothyroidism.

### Methodology

This observational, cross-sectional study was conducted after getting approval from the Institutional Ethics Committee of Bangalore Medical College and Research Institute. It was conducted on patients attending OPD/ IPD of Hospitals affiliated to Bangalore Medical College and Research Institute, Bangalore from November 2019 to May 2021 who gave written informed consent and satisfy the inclusion and exclusion criteria. The inclusion criteria included age more than 18 years, treatment naïve hypothyroid patients, patients who are willing to participate in the study and give informed written consent. The exclusion criteria were age below 18 years, Diabetes Mellitus, Hypertension or any other systemic illness that may affect the renal function, pregnancy, hepatic, renal diseases or bone disorders, on drugs that affect uric acid excretion.

The data about basic demographic data, clinical history and examination was collected in a pre-designed case record form. For the purpose this study, patients were subjected to thyroid function tests (TFT), renal function tests (RFT), complete hemogram with peripheral smear, serum ferritin and serum lactate dehydrogenase (S. LDH) levels estimation were done and results were recorded in the case record form.

The collected data were analyzed by descriptive statistics. Pearson correlational analysis/Spearman's rank correlation was used to assess the correlation between Uric acid and TSH levels.

**RESULTS**

The data obtained was analyzed and the results obtained were as follows:

The mean age of the subjects was found to be 32±8 years. Out of 90 subjects, 35(39%) were of age group 20-30 years, 32(26%) were of age groups 30-40 years, and 23(26%) were 40-50 years of age(table 1& figure 1). Out of 90 subjects, 82(91%) were females and only 8(9%) were males (table 2& figure 2). The average height of the subjects was 158.67±9.31 cm and the average weight was 63.94±9.72 kg. The average BMI of the subjects was found to be 25.51±4.17 (kg/m<sup>2</sup>). The mean pulse rate of the subjects was 75.62±5.66, mean RR was 18.63±1.83, mean BP was 111±7/75±5 (table 3&4).

The average T3 was observed to be 1.59±0.96, average T4 was 3.83±3.73 and average TSH was 30.89±20.93 (table 5). The mean serum uric acid of the subjects was 6.3±1.28 mg/dl, mean serum creatinine was 0.87±0.15 mg/dl and mean eGFR was 85.44±16.45 (table 6).

The mean HB was 11.58±1.69, MCV was 79.81±6.76, Total count was 8379.79±3656.57, Platelet count was 2.92±1.35. The average Ferritin was found to be 185.21±359.03 (table 7). The average LDH was 296.46±106.35. Out of 90 subjects microcytic hypochromic anemia was present in 21(23%) subjects and normocytic normochromic anemia was present in 69(77%) subjects (table 8&figure 3) Pearson correlation analysis showed that there was positive association between TSH and serum uric acid, among the subjects. However, the association was not found to be statistically significant as p>0.05. (table 9 &figure 4)

**DISCUSSION**

In this study, out of 90(100%) patients, 35(39%) were in the age group of 20-30 years, 32(26%) were in the age groups of 30-40 years, and 23(26%) were 40-50 years of age. However, In general, it is hypothesized that as the aging process leads to a hypothyroid status termed "physiological aging" resulting in a reduction of the basal metabolism.(15)This could be a possible explanation for the loss a any association with SCH in our study since majority of the cases taken up for the study were between 40 to 50 years.

Although hypothyroidism and SCH is commoner in females, in our study, it was noted that, out of 82(91%) were females and only 8(9%) were males. This obtained data is similar to a study carried out by S. Haritha et al,(16) in which there were 76% females & 24% males out of 100 patients. Our data is also closely related to a study out by Ashok Kumar et al, (17) in which there were 63.5% females & 36.5% males.

In the present study, the average BMI of the subjects was found to be 25.51±4.17 (kg/m<sup>2</sup>). Zulewski et al.,(18) 69 who noted a significant rise in BMI in hypothyroid patients. Abalovich. M et al (19) also cited that weight gain is a common feature in hypothyroidism. Ashok kumar et al (20) also cited that 56.3 % patients of hypothyroidism were having weight gain in his study.

In the present study, the mean HB was found to be 11.58±1.69 It was seen that anemia was significantly associated with overt hypothyroidism than SCH in the study by M'Rabet-Bensalah et al.(21) Although all the patients below a Hb of 11.5 were excluded from the study since anaemia by itself could be a confounding factor for symptoms of severity of heart failure, it was seen that lower Hb had a statistically significant association with raising TSH levels in our study. Hence, the definitive association of SCH with anaemia needs further

evaluation. The present study demonstrated that there was positive association between TSH and serum uric acid, among the subjects. However, the association was not found to be statistically significant as p>0.05. Khan et al.(22) and Giordano et al.(23) found significant association between uric acid and TSH. Raber et al. (24) who conducted a screening study on a large number of patients suffering from various degrees of thyroid dysfunction including hyperthyroidism and hypothyroidism, they couldn't find any association between serum uric acid level and TSH.

The disagreement between these finding and our results can be explained by the differences in the studied population and in sample size. The relationship between uric acid level and thyroid dysfunction has been investigated in several studies, which provided conflicting results.

Mean serum uric acid level in our study was higher in hypothyroid patients as compared to hyperthyroid and this is consistent with the previous studies. It was found that, the administration of levothyroxine in these hypothyroid hyperuricemic patients resulted in the normalization of TSH, FT4, serum and urinary uric acid levels as well as creatinine and creatinine clearance values.

This fact suggests that hypothyroid hyperuricemia could be secondary to a reduction in renal plasma flow and glomerular filtration. Thus the reduction in serum uric acid level that was observed under replacement therapy with levothyroxine could be theoretically due to improvement in its renal excretion. (25–34)

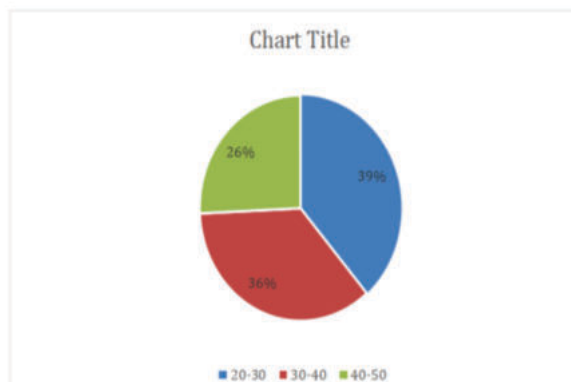
**CONCLUSION**

Although not statistically significant, a positive correlation was observed between the two parameters. Despite the small number of the patients examined, the present study shows that hyperuricemia is a common feature hypothyroidism. Therefore, we should emphasize the importance of the routine evaluation of serum and urinary uric acid levels, in patients affected by hypothyroidism. In this way we will be able to correct the possibly altered purine nucleotide metabolism and to prevent the onset of gout, which can worsen thyroid endocrine disorders.

**Tables and figures**

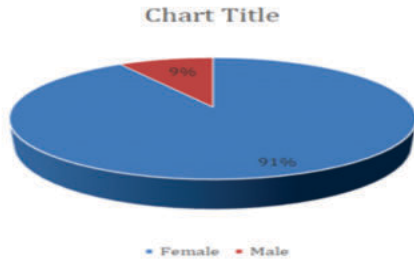
Age in Years	N	%
20-30	35	39%
30-40	32	36%
40-50	23	26%
<b>Grand Total</b>	<b>90</b>	<b>100%</b>

Table 1: Age distribution



Sex	N	%
Female	82	91%
Male	8	9%
<b>Grand Total</b>	<b>90</b>	<b>100%</b>

**Table 2: Gender distribution**



**Figure 2: Gender Distribution**

	Mean±SD
Ht (cm)	158.67±9.31
Wt (kg)	63.94±9.72
BMI(kg/m <sup>2</sup> )	25.51±4.17

**Table 3: Mean Ht, Wt & BMI**

	Mean±SD
PR(per min)	75.62±5.66
RR (per min)	18.63±1.83
Systolic BP	111±7
Diastolic BP	75±5

**Table 4: Mean PR, RR, BP**

	Mean±SD
Sr. uric acid mg/dl	6.3±1.28
Sr.Creatinine mg/dl	0.87±0.15
e GFR	85.44±16.45

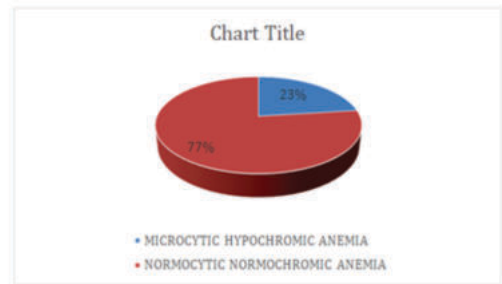
**Table 6: Mean UA, creatinine and eGFR**

	Mean±SD
HB	11.58±1.69
MCV	79.81±6.76
TC	8379.79±3656.57
PLT	2.92±1.35
FERRITIN	185.21±359.03
LDH	296.46±106.35

**Table 7: Mean Hb, MCV, TC, Plt, Ferritin, LDH**

PERIPHERAL SMEAR	N	%
MICROCYTIC HYPOCHROMIC ANEMIA	21	23%
NORMOCYTIC NORMOCHROMIC ANEMIA	69	77%
<b>Grand Total</b>	<b>90</b>	<b>100%</b>

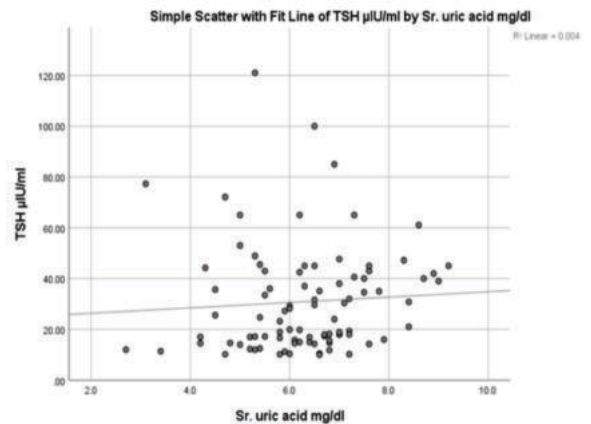
**Table 8: Morphological type of anemia distribution**



**Figure 3: Morphological type of anemia distribution**

		Sr. uric acid mg/dl
TSH µIU/ml	Pearson Correlation	0.065
	p-value	0.543
	N	90

**Table 9: TSH and uric acid correlation**



**Figure 4: TSH and uric acid correlation**

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