



COMPARISON OF SERUM CREATININE, UREA AND URIC ACID BETWEEN HYPOTHYROIDISM AND HYPERTHYROIDISM SUBJECTS COMING AT TERTIARY REFERRAL HOSPITAL, KANPUR

Biochemistry

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ABSTRACT

Thyroid dysfunction is related to damaging effect on glomerular and tubular functions. Hypothyroidism and hyperthyroidism was accompanied with renal derangement resulting in abnormal levels of serum creatinine, urea and uric acid. In this comparative study, serums of 90 Subjects (30- Hypothyroidism, 30- Hyperthyroidism and 30-Controls) were analysed for Urea, Creatinine, Uric acid and Thyroid Profile. A significant increase in creatinine, urea and uric acid ($p=0.000$) in hypothyroidism patients. Hyperthyroidism patients showed significant decrease in creatinine levels ($p=0.000$) and no significant change was seen in urea and uric acid levels. In hypothyroidism, TSH showed significant positive correlation with creatinine only ($p=0.002$). Correlations of TSH with other parameters were not significant in both hypothyroidism and hyperthyroidism ($p > 0.05$).

KEYWORDS

Thyroid Dysfunction, Creatinine, Urea, Uric acid.

INTRODUCTION

Thyroid disease consequences have been found increasing day by day affecting all age groups in both males and females. Thyroid hormones play a vital role in metabolic and physiologic homeostasis and regulate cardiac output, heart rate, ventilation rate, basal metabolic rate, effects of catecholamines, brain and endometrium development, catabolism of proteins and carbohydrates^[1]. Hyperthyroidism and hypothyroidism conditions are mainly concerned with amount of triiodothyronine (T3) and tetraiodothyronone (T4) secretion in blood affecting the metabolism and biological functions^[2]. Hypothyroidism is the most common thyroid disorder among the endocrine disorders^[3]. Long standing hypothyroidism can cause significant changes in renal function such as a decrease in sodium reabsorption, impairment in the concentrating and diluting capacities of the distal tubules, a decrease in the urinary urate excretion and a decrease in the renal blood flow and glomerular filtration rate (GFR)^[4]. The deficiency of thyroid hormones also reduces the cardiac output leading to generalized hypodynamic state of the circulatory system^[5]. The cause of the decreased renal plasma flow and GFR observed is believed to be principally due to the generalized hypodynamic state of the circulatory system in hypothyroidism^[6]. Hyperthyroidism is a thyroid disorder characterized by decrease in TSH level. Very few studies show the effect of hyperthyroidism on renal function. Hyperthyroidism is mainly associated with decreased serum creatinine levels due to elevated renal plasma flow and GFR.^[7,8]

Very few studies have been done on Indian population which shows that hypothyroidism and hyperthyroidism alter non-protein nitrogenous (NPN) substances like creatinine, urea and uric acid levels. Hence the present study was undertaken to study these non-protein nitrogenous substances in hypothyroid and hyperthyroid patients.

MATERIALS AND METHODS

Upon ethical clearance, this hospital based comparative study was conducted in biochemistry department on **90 subjects** (30 newly diagnosed and untreated cases of hypothyroidism, 30 newly diagnosed and untreated cases of hyperthyroidism and 30 healthy controls) in the similar age group, attending OPD of general medicine of Rama Medical College, Hospital & Research Centre, Kanpur, Uttar Pradesh, India. Detailed information of the patients was collected with the help of pre-test proforma that included age, sex and family or personal history of chronic diseases.

Inclusion criteria

- Subjects between 18–60 years age group will be considered.
- Known hypothyroid patients, on analysis with Thyroid hormones [Low serum T3 & T4 and High TSH]
- Known hyperthyroid patients, on analysis with Thyroid hormones [high serum T3, T4 and low TSH], will be considered as cases.

Exclusion criteria

- Age group (<18 years or >60 years)
- Pregnant ladies
- Known cases of renal disorders, hepatic disorders, bone disorders, diabetes, hypertension or any other systemic illness that may affect the renal function will be not included in the study.

Method of Analysis:

5ml of fasting venous blood sample was collected from each participant in a plain vacutainer under all aseptic conditions. Serums were separated and used for various biochemical assays.

Thyroid function assays:

TSH, T4 and T3 were measured by Fluorescence Enzyme Immunoassay method on TOSOH AIA-360 auto analyzer^[9]

The Urea, Creatinine and Uric acid were analyzed on Erba Chem 5-plus semi-auto analyzer according to the protocol mentioned in the test kits from Erba Mannheim.

- Serum Urea will be estimated by GLDH (Urease) method.
- Serum Creatinine will be estimated by Jaffe's method.
- Serum Uric acid will be estimated by Modified Trinder Peroxidase method^[10].

Statistical analysis:

All the parameters of patients and control were analyzed for mean, and standard deviation. The results were expressed as Mean $\pm$ standard deviation. Data was analyzed by statistical software **SPSS VERSION 21.0**. Comparison was done by using student's 't' test. Pearson's correlation coefficient was used to find the correlation between TSH and serum concentration of Urea, Uric acid and Creatinine.

RESULTS

Table 1- Comparison Of Thyroid Profile Levels Between Patients (hypothyroidism & Hyperthyroidism) And Controls.

Parameters	Hypothyroidism Patients (Mean $\pm$ SD)	Controls (Mean $\pm$ SD)	Hyperthyroidism Patients (Mean $\pm$ SD)
TSH (μ U/ml)	33.93 $\pm$ 36.12	2.65 $\pm$ 1.10	0.08 $\pm$ 0.06
	'p' value .000	'p' value .000	
T4 (μ g/dl)	6.11 $\pm$ 3.79	9.23 $\pm$ 1.14	14.28 $\pm$ 4.56
	'p' value .000	'p' value .000	
T3 (ng/ml)	1.19 $\pm$ 0.70	1.15 $\pm$ 0.19	2.65 $\pm$ 1.26
	'p' value .780	'p' value .000	

A 'p' value < 0.05 was considered significant.

A 'p' value < 0.01 was considered highly significant.

Table 1 showed the mean values of T3, T4 & TSH in hypothyroidism,

hyperthyroidism and control group (1.19 ng/ml, 6.11 µg/dl & 33.93 µIU/ml), (2.65 ng/ml, 14.28 µg/dl & 0.08 µIU/ml) and (1.15 ng/ml, 9.23 µg/dl & 2.65 µIU/ml) respectively. It was seen that T3 and T4 levels significantly decreased in hypothyroidism and significantly increased in hyperthyroidism when compared to control. There was also a significant difference in TSH values among hypothyroidism, hyperthyroidism and control.

Table 2: Comparison Of Creatinine, Urea And Uric Acid Between Patients (hypothyroidism& Hyperthyroidism) And Controls.

Parameters	Hypothyroidism Patients (Mean ± SD)	Controls (Mean ± SD)	Hyperthyroidism Patients (Mean ± SD)
Creatinine (mg/dl)	1.06 ± 0.26	0.83 ± 0.13	0.63 ± 0.09
	'p' value .000		'p' value .000
Urea (mg/dl)	41.85 ± 11.05	27.56 ± 5.91	28.00 ± 4.87
	'p' value .000		'p' value .758
Uric acid (mg/dl)	9.34 ± 4.62	4.18 ± 0.96	4.45 ± 0.86
	'p' value .000		'p' value .258

A 'p' value < 0.05 was considered significant.

A 'p' value < 0.01 was considered highly significant.

The Table 2, showed that the levels of serum creatinine, urea and uric acid significantly increased in hypothyroid patients (1.06 mg/dl, 41.85 mg/dl and 9.34 mg/dl) compared to control (0.83 mg/dl, 27.56 mg/dl and 4.18 mg/dl) with p value <0.000. In hyperthyroid patients, the serum creatinine level (0.63 mg/dl) was decreased as compared to controls (0.83 mg/dl) with p value <0.000. However, there was no significant difference was found in the levels of urea and uric acid between hyperthyroidism (28.00 mg/dl and 4.45 mg/dl) and control (27.56 mg/dl and 4.18 mg/dl).

Table 3: Pearson Correlation Between Serum Tsh With Creatinine, Urea And Uric Acid Levels In Hypothyroidism And Hyperthyroidism.

Lab variables	TSH Group	n	Pearson Correlation	'p' value
Creatinine (mg/dl)	hypothyroidism	30	.534**	.000
	hyperthyroidism	30	.033	.02
Urea (mg/dl)	hypothyroidism	30	-.102	.002
	hyperthyroidism	30	-.188	.320
Uric acid (mg/dl)	hypothyroidism	30	.320	.01
	hyperthyroidism	30	-.315	.090

A 'p' value < 0.05 was considered significant.

A 'p' value < 0.01 was considered highly significant.

'n' - number of subject.

Table 3 showed positive correlation of creatinine, urea and uric acid levels with TSH in hypothyroidism while in hyperthyroidism only creatinine showed positive correlation with TSH.

DISCUSSION

In the Present study, conducted in the Department of Biochemistry, Rama Medical College, Hospital & Research Centre, Kanpur, Uttar Pradesh, India, we evaluated the effect of hypothyroidism and hyperthyroidism on Creatinine, Urea and Uric acid and compared it with control. The results of this comparative study showed female dominance in both Hypothyroidism and Hyperthyroidism. Ratio of female over male is 2:1 and 4:1 respectively. Mean age of hypothyroidism patients, hyperthyroidism patients and control were 38.33, 38.1 and 33.7 years respectively. Most of the hypothyroidism patients belonged to 31 to 40 years age group, hyperthyroidism patients belonged to 18 to 30 years age group and control belonged to 18 to 30 years age group.

In this study, the mean values of T3, T4 & TSH of hypothyroidism, hyperthyroidism and control group were (1.19 ng/ml, 6.11 µg/dl & 33.93 µIU/ml), (2.65 ng/ml, 14.28 µg/dl & 0.08 µIU/ml) and (1.15 ng/ml, 9.23 µg/dl & 2.65 µIU/ml) respectively (Table 1). It was seen that T3 and T4 levels significantly decreased in hypothyroidism and significantly increased in hyperthyroidism when compared to control. There was also a significant difference in TSH values among hypothyroidism, hyperthyroidism and control. This is in accordance with the study done by Hemantha Kumara D.S et al^[10]. 2017 and Taruna Bharati et al^[11]

The Table 2, showed that the levels of serum creatinine, urea and uric acid significantly increased in hypothyroid patients (1.06 mg/dl, 41.85 mg/dl and 9.34 mg/dl) compared to control (0.83 mg/dl, 27.56 mg/dl and 4.18 mg/dl) with p value <0.000. Similar findings were seen in subsequent studies of Gagandeep Kaur Sidhu^[12], Nagarajappa et al^[14], Sarika Arora et al^[16] and Khan et al^[17]. However Qahtan A.Rashead et al^[13] showed that there was no significant difference between normal & abnormal values of urea in hypothyroid patients and controls.

In hyperthyroid patients, the serum creatinine level (0.63 mg/dl) was decreased as compared to controls (0.83 mg/dl) with p value <0.000. However, there was no significant difference was found in the levels of urea and uric acid between hyperthyroidism (28.00 mg/dl and 4.45 mg/dl) and control (27.56 mg/dl and 4.18 mg/dl). This is in accordance with the study of Hemantha Kumar D.S. et al^[10] who showed decreased creatinine levels in hyperthyroidism while taruna Bharti et al^[11] showed that these levels were raised mildly in about 12% of hypothyroid patients. Gulabkanwar et al^[15] showed that hyperuricemia is also seen in hyperthyroidism which is in contrast to our study.

In our study, creatinine, urea and uric acid levels showed positive correlation with TSH in hypothyroidism while in hyperthyroidism only creatinine showed positive correlation with TSH (Table 3). In hypothyroid patients, a significant decrease was observed in serum Creatinine, after 6 weeks of thyroxine replacement therapy^[16]

The elevated serum creatinine, urea and uric acid levels in hypothyroid patients are due to physiological effects including alterations in renal hemodynamic, decrease in GFR and reduced clearance.^[14,17] There are only few studies explaining the effect of hyperthyroidism on renal function. Decreased creatinine level in hyperthyroidism may be due to an increase in renal plasma flow and GFR resulting in a reduction of serum creatinine levels. Another possible mechanism of action of thyroid hormone on renal function could be explained by its influence on maturation of the renin-angiotensin system (RAAS). Plasma renin activity and plasma levels of angiotensinogen, angiotensin II and aldosterone are directly associated to plasma levels of thyroid hormones^[18]. Hypothyroidism is associated with low plasma renin, which may cause an increase in creatinine and uric acid levels^[19]. In contrast, hyperthyroidism is accompanied by hyperactivity of the RAAS^[20]. T3 also induces relaxation of blood vessel resulting in a reduction in vascular resistance and increases serum levels of renin activity and angiotensinogen concentration. This leads to decrease in TSH with increase in T3 and T4 and decreased creatinine levels without much effect on uric acid levels^[21].

CONCLUSION

Present study shows that there is significantly higher creatinine, urea and uric acid levels in hypothyroidism patients and significantly lower creatinine level in hyperthyroidism patients with no significant changes in other parameters (Urea and Uric acid) compared to control group. These changes in the biochemical values is because of the renal dysfunction. Thus these findings are helpful in understanding the interaction between thyroid gland and kidney showing the detrimental effect of hypothyroid and hyperthyroid state on renal functioning. Therefore, in case of deranged renal function, thyroid function tests should be carried out routinely to know the status of thyroid gland and vice-versa.

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