

# Study of Serum Creatinine Level in Hypothyroidism

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## ABSTRACT

**Background:** Hypothyroidism is associated with many biochemical abnormalities. Many studies were done abroad regarding serum creatinine levels in hypothyroid patients. We designed this study in our population to evaluate serum creatinine levels in hypothyroid patients.

**Objective:** To assess serum creatinine levels in hypothyroid patients and to find out the relationship of creatinine levels with the severity of hypothyroidism.

**Materials and methods:** This is a retrospective cross-sectional study that aims to evaluate the serum creatinine levels of hypothyroid patients and to find out the relationship between hypercreatininemia and severity of hypothyroidism. The study was done in the Department of Biochemistry, PDU Medical College and attached group of hospitals, Churu, western Rajasthan. Results were compared with that of age- and sex-matched healthy euthyroid controls. Statistical analyses were done by using the SPSS version 16.0. ANOVA and unpaired *t* tests were done to see the significance among the groups and between groups, respectively. The Pearson's correlation coefficient test was done to see the correlation of serum creatinine with the severity of hypothyroidism.

**Results:** Mean serum creatinine levels in cases were  $0.922 \pm 0.16$  compared to  $0.798 \pm 0.098$  mg/dL in controls.

**Conclusion:** Mean serum creatinine levels were found significantly higher in hypothyroid patients compared to controls. These findings suggest that hypercreatininemia is associated with hypothyroidism. Therefore, patients presenting with this biochemical abnormality are recommended to be investigated to explore hypothyroidism.

**Keywords:** Autoimmune diseases, Hypercreatininemia, Hypothyroidism, Thyroid hormones.

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## INTRODUCTION

Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones, which, in turn, results in a generalized slowing down of metabolic processes.<sup>1</sup> It is a common metabolic disorder in general population.<sup>2</sup> The thyroid dysfunction increases with age, especially in women.<sup>3</sup>

The prevalence of primary hypothyroidism is 1:100 but it may be 5:100 if patients with subclinical hypothyroidism [normal T4, raised thyroid stimulating hormone (TSH)] are included (0.5–2.0% in female and 0.2% in male).<sup>4</sup> Iodine deficiency is the most common cause of hypothyroidism worldwide.<sup>5</sup> In most parts of the world, iodine is a scarce component of soil, and hence it is little in food.<sup>6</sup> In area of iodine sufficiency, autoimmune disease (Hashimoto's thyroiditis) and iatrogenic causes are the most common causes of hypothyroidism.<sup>5</sup>

Hypothyroidism is associated with many biochemical abnormalities including increased serum creatinine levels. The serum creatinine concentration increases in hypothyroid patients due to reduction of glomerular filtration.<sup>7</sup> The serum creatinine level may also be increased due to hypothyroid myopathy. In hypothyroidism, associated autoimmune diseases may also play a role in modifying the underlying renal problem.

## MATERIALS AND METHODS

### Place of Study

The study was conducted in collaboration of Department of Medicine and Department of Biochemistry at PDU Medical College and attached group of hospitals, Churu, between January 2019 and July 2019.

### Ethical Committee

Approval was obtained from the Ethical Committee of PDU Medical College, Churu, Rajasthan.

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**Conflict of interest:** None

## Study Design

It was a prospective cross-sectional study.

## Sample Size

We included total 100 subjects out of which 50 subjects were diagnosed cases of hypothyroidism and 50 served as control.

## Study Population

People attending the outpatient Department of Medicine and Biochemistry laboratory of PDU Medical College and attached group hospitals.

## Inclusion Criteria

Patients which were newly detected cases of hypothyroidism in age group of 21–45 years. Both male and female patients were included in the study.

## Exclusion Criteria

Persons on thyroxine treatment, pregnancy, lactating mothers, renal disease, liver disease, cardiovascular disease, hypertension,

diabetes mellitus, gout, muscular disorders, malignancy, smoking, alcoholism, patients on drugs (hypolipidemic drugs, antihypertensives, steroids, probenecid, allopurinol, etc.), and H/o chemotherapy or radiotherapy for malignancy were excluded.

### Control Group

Both male and female persons in the age group of 21–45 years having normal thyroid profile (euthyroid) acted as control.

### Estimation of Creatinine

#### Method

Modified Jaffe's method (alkaline picrate method).

## RESULTS

The creatinine levels in hypothyroid patients and euthyroid controls were analyzed using the unpaired Student's *t* test, and correlation between the thyroid profile (T3, T4, TSH) and the serum creatinine value in hypothyroid patients was analyzed using the Pearson's correlation coefficient test (Table 1). By means of Statistical Package for Social Sciences (SPSS) software version 16, the analysis of statistics was performed. The statistical significance was drawn at *p* value <0.05 (Table 2).

According to Table 3, when comparing the serum creatinine level between cases and controls it was found that there was a significant increase in the creatinine value in the study group than in the control group.

According to Table 4, when correlating between the thyroid profile (T3, T4, TSH) and serum creatinine in hypothyroid patients, the correlation between T4 and creatinine, correlation between T3 and creatinine, and correlation between TSH and creatinine were all weak and not statistically significant.

## DISCUSSION

The present study aimed to evaluate the effect of hypothyroidism on serum creatinine concentration and to compare it with euthyroid subjects and also to study the correlation.

**Table 1:** Age distribution among cases and control groups

Age (in years)	Case	Control	Total
21–30	15	30	45
31–40	25	12	37
41–45	10	08	18
Total	50	50	100
Mean	34.14	29.92	
Standard deviation	6.95	7.33	
<i>p</i> value	0.00396	Significant	

**Table 2:** Sex distribution among cases and control groups

Gender	Case	Control	Total
Male	5	4	9
Female	45	46	91
Total	50	50	100

**Table 3:** Mean value of creatinine among cases and control groups

Substance	Case		Control		<i>p</i> value
	Mean	SD	Mean	SD	
Creatinine (mg/dL)	0.922	0.16	0.798	0.098	<0.00001 significant

Persons with age group 21–45 years were included in this study. Mean ages of this study group and control group were 34.14 years and 29.92 years, respectively. Most of the people in this study belong to age group of 31–40 years and control group belong to age group of 21–30 years, which is similar to a study done by Chaudhury et al.,<sup>8</sup> the most common age group 30–39 years, the mean age of hypothyroid and controls were nearly same. However, hypothyroidism was found more common in the 25–35 years age group, similar to the study done by Rashead et al.,<sup>9</sup> with highest percentage of people were in the age group 26–45 years.

Among cases, 5 were males and 45 were females and in healthy controls 4 were males and 46 were females. The percentage rate of females was more than the percentage rate of males, similar to the study by Chaudhury et al., who recorded hypothyroidism that was more frequent in females. Qahtan et al. and Tejomani et al.<sup>10</sup> also observed that prevalence of hypothyroidism was higher among females.

The mean serum creatinine values of the study and control groups were 0.922 and 0.798 mg/dL, respectively. When comparing the mean serum creatinine values between study and control groups, it was high in the study group than in the control group and the difference was statistically highly significant. This is due to the effect of hypothyroidism on renal physiology, which leads to decrease in renal plasma flow and impaired glomerular filtration and impaired creatinine excretion, thereby increase in serum creatinine levels.

Jayagopal et al.<sup>11</sup> studied the effects of the hypothyroid state on changes in serum creatinine in 17 patients with hypothyroidism. All patients were newly diagnosed. The hypothyroid patients had a mean serum creatinine level of 1.02 mg/dL. It had been confirmed that the rise in creatinine levels in hypothyroid patients did not relate to abnormalities in other renal functions or creatine kinase levels suggesting that neither hypothyroid myopathy nor intrinsic renal disease contributed to the changes seen in creatinine levels. Similar results were found by Tayal et al.<sup>12</sup> and Sinisa et al.<sup>13</sup> In this study, serum creatinine had positive correlation with T3 (0.0621) and TSH (0.1631), and negative correlation with T4 (–0.0645). But all were weak and statistically not significant.

In Tayal et al., there was significant negative correlation between serum creatinine and serum T3 and T4 levels and a significant positive correlation of serum creatinine with TSH levels. In Tejomani et al., there was a significant negative correlation between T3 and creatinine and a significant positive correlation between creatinine and TSH. In Chaudhary et al., TSH had a positive significant correlation with serum creatinine. Mamatha et al.<sup>14</sup> showed a significant positive correlation between TSH and serum creatinine levels.

In Jia et al.,<sup>15</sup> TSH showed a weak negative correlation with creatinine, fT3, and fT4 and also showed a significant negative correlation with creatinine. In Kaur et al.,<sup>16</sup> TSH showed a significant positive correlation with serum creatinine levels whereas fT4 and fT3 did not show any significant correlation with creatinine. Therefore, these studies are showing mixed observations.

## CONCLUSION

The present study showed that there is increased creatinine levels in the study group as compared to the control group. These changes in

**Table 4:** Correlation between thyroid profile and serum creatinine levels in hypothyroid patients

Thyroid hormones	Serum creatinine (mg/dL) r value	p value
T3 (ng/mL)	0.0621	0.668 (not significant)
T4 (µg/dL)	-0.0645	0.658 (not significant)
TSH (µIU/mL)	0.1631	0.258 (not significant)

the biochemical values are because of the renal dysfunction leading to decrease in the e-GFR level. Thus, these findings are helpful in understanding the interaction between the thyroid gland and the kidney, showing the detrimental effect of the hypothyroid state on renal functioning. This renal impairment is often overlooked but is readily reversible by prompt treatment leading to normalization of biochemical markers.

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