

Original Article

Assessment of Serum Creatinine Concentrations in Individuals with Hypothyroidism

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Abstract:

Background: Hypothyroidism is a clinical syndrome caused by insufficient production of thyroid hormones, leading to a generalized slowing of metabolic processes. It is a common endocrine disorder, with higher prevalence in women and increasing frequency with age. Subclinical hypothyroidism, characterized by elevated thyroid-stimulating hormone (TSH) with normal T3 and T4 levels, may often remain asymptomatic but can still impact metabolic and organ functions.

Objective: To assess serum creatinine concentrations in patients with hypothyroidism and explore its correlation with thyroid hormone levels.

Materials and Methods: A prospective cross-sectional study was conducted at Northeast Medical College, Sylhet, from July 2024 to June 2025. A total of 110 participants were included, comprising 55 newly diagnosed hypothyroid patients and 55 were normal thyroid profiles (euthyroid) controls, aged 21–45 years. Statistical analysis was performed using SPSS version 25, with chi-square test, t test and spearman correlation applied to assess significance ($p < 0.05$).

Results: The mean age of cases was 33.77 ± 6.24 years, and controls 30.91 ± 6.87 years, with a significant age difference ($p = 0.026$). Females predominated in both groups (cases 89.1%, controls 90.9%), with no significant difference in sex distribution ($p = 0.751$). Mean serum creatinine was significantly higher in hypothyroid patients (0.926 ± 0.14 mg/dL) compared to controls (0.795 ± 0.087 mg/dL; $p = 0.001$). Correlation analysis between thyroid hormones and creatinine in hypothyroid patients showed weak and non-significant associations: T3 ($r = 0.072$, $p = 0.455$), T4 ($r = -0.066$, $p = 0.500$), and TSH ($r = 0.154$, $p = 0.110$).

Conclusion: Serum creatinine levels were significantly elevated in individuals with hypothyroidism compared to euthyroid controls, indicating an impact of thyroid dysfunction on renal function. Although correlations between thyroid hormones and serum creatinine were weak and not statistically significant, routine monitoring of renal parameters in hypothyroid patients may be clinically beneficial.

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Introduction:

Hypothyroidism results from dysfunction of the hypothalamic-pituitary-thyroid axis, leading to elevated thyroid-stimulating hormone (TSH) levels and reduced circulating T3 and T4.

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Subclinical hypothyroidism, on the other hand, is characterized by normal T3 and T4 levels but elevated TSH, often without overt clinical symptoms.¹⁻³ The thyroid and kidneys share a complex physiological relationship, with thyroid dysfunction significantly affecting renal function, particularly glomerular filtration rate (GFR).²

Creatinine, a key marker of renal function, is produced from creatine phosphate metabolism in skeletal muscles and the brain.³ Despite the recognized interplay between thyroid and kidney function, limited clinical studies have specifically evaluated the impact of hypothyroidism on renal function.⁴ Hypothyroidism is often associated with a reduction in GFR, leading to decreased clearance of creatinine and, consequently, higher serum creatinine levels. Increased creatinine may also result from enhanced muscle breakdown in hypothyroid myopathy^{5,7}.

Hypothyroidism is a clinical syndrome caused by thyroid hormone deficiency, resulting in a generalized slowing of metabolic processes. It is a common metabolic disorder, with prevalence increasing with age, particularly in women.³ Primary hypothyroidism affects approximately 1% of the general population, but this may rise to 5% when including subclinical cases (0.5–2.0% in females and 0.2% in males). Iodine deficiency remains the most common cause globally, especially in areas where soil and food iodine content is low. In regions with adequate iodine intake, autoimmune thyroid disease (Hashimoto's thyroiditis) and iatrogenic causes are the predominant etiologies.³

Hypothyroidism is associated with multiple biochemical abnormalities, including elevated serum creatinine levels. This increase primarily results from reduced GFR and may be compounded by hypothyroid-related myopathy. Additionally, associated autoimmune disorders may further contribute to underlying renal dysfunction in these patients.⁸ The present study aimed to evaluate serum creatinine levels in patients with hypothyroidism and investigate their relationship with thyroid hormone concentrations.

Methods and materials

The study was a prospective cross-sectional study conducted in collaboration between the Department of Medicine and the Department of Biochemistry at Northeast Medical College, Sylhet, from July 2024 to June 2025. A total of 110 subjects were included, of which 55 were newly diagnosed cases of hypothyroidism and 55 were individuals with normal thyroid

profiles (euthyroid) served as controls. Study participants were recruited from the outpatient Department of Medicine and the Biochemistry Laboratory of North East Medical College, Sylhet, within the age group of 21–45 years. Both male and female participants were included. Exclusion criteria were: subclinical hypothyroidism, patients on thyroxine therapy, pregnant or lactating women, individuals with renal, liver, cardiovascular disease, hypertension, diabetes mellitus, gout, muscular disorders, or malignancy, smokers or alcoholics, patients on drugs such as hypolipidemic agents, antihypertensives, steroids, probenecid, allopurinol, or those with a history of chemotherapy or radiotherapy for malignancy. Serum creatinine levels were measured using the Modified Jaffe's method (alkaline picrate method). Ethical approval for the study was obtained from the Ethical Committee of North East Medical College, Sylhet. Data were analyzed using Statistical Package for Social Sciences (SPSS) for Windows, version 25. Chi-square test, t test and spearman correlation were used to determine statistical significance, with a p-value < 0.05 considered significant.

Result

Table 1 presents the baseline characteristics of The mean age of the cases was 33.77 ± 6.24 years, while the mean age of controls was 30.91 ± 6.87 years. Age distribution between the groups was significantly different ($p = 0.026$), indicating that a higher proportion of younger individuals (21–30 years) were present in the control group (58.2%) compared to cases (30.9%), whereas individuals aged 31–40 years were more prevalent among cases (50.9%) than controls (25.5%). This suggests that age may be associated with the occurrence of hypothyroidism in the study population (Table 1). Among the study subjects, females predominated in both cases (89.1%) and controls (90.9%), while males constituted a small proportion (cases 10.9%, controls 9.1%). The difference in sex distribution between the groups was not statistically significant ($p = 0.751$), indicating that sex was comparable between cases and controls (Table 2). The mean serum creatinine was significantly higher in hypothyroid patients (0.926 ± 0.14 mg/dL) compared to controls (0.795 ± 0.087 mg/dL), with a p-value of 0.001. This demonstrates that hypothyroidism is

associated with elevated serum creatinine levels, likely due to reduced glomerular filtration and possible contribution from hypothyroid myopathy (Table 3). Cases had significantly lower mean T3 (0.80 ± 0.25 vs. 1.30 ± 0.30 ng/mL) and T4 (5.2 ± 1.4 vs. 8.8 ± 1.6 µg/dL) levels, while TSH was significantly higher (12.5 ± 6.0 vs. 2.3 ± 1.1 µIU/mL) compared to controls (Table 4). Correlation analysis between thyroid hormones and serum creatinine in hypothyroid patients showed no statistically significant associations. T3 ($r = 0.072$, $p = 0.455$), T4 ($r = -0.066$, $p = 0.500$), and TSH ($r = 0.154$, $p = 0.110$) all demonstrated weak correlations with serum creatinine levels (Table 5).

Table 1: Table 1: Age distribution of the study subject (n=110)

Age in years	Case (n=55)		Control (n=55)		P value
	No	%	No	%	
21-30	17	30.9	32	58.2	0.026
31-40	28	50.9	14	25.5	
41-45	10	18.2	9	16.4	
Mean±SD	33.77±0.624		30.91±6.87		

Data were analyzed using chi-square test

Table 2: Sex distribution of study subject (n=110)

Sex	Case (n=55)		Control (n=55)		P value
	No	%	No	%	
Male	6	10.9	5	9.1	0.751
Female	49	89.1	50	90.9	

Data were analyzed using chi-square test

Table 3: Mean value of creatinine of study subject (n=110)

	Case (n=55)		Control (n=55)		P value
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	
Creatinine	0.926±0.14		0.795±0.087		0.001

Data were analyzed using t test

Table 4: Thyroid hormone level in case and control (n=110)

Thyroid hormones	Case (n=55)		Control (n=55)		P value
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	
T3 (ng/ml)	0.80 ± 0.25		1.30 ± 0.30		0.001
T4 (µg/dL)	5.2 ± 1.4		8.8 ± 1.6		0.001
TSH (µIU/mL)	12.5 ± 6.0		2.3 ± 1.1		0.001

Data were analyzed using t test

Table 5: Correlation between thyroid profile and serum creatinine levels in hypothyroid patients (n=110)

Thyroid hormones	r value	P value
T3 (ng/ml)	0.072	0.455
T4 (µg/dL)	-0.066	0.500
TSH (µIU/mL)	0.154	0.110

Data were analyzed using spearman correlation

Discussion:

Hypothyroidism is a clinical disorder resulting from a deficiency of thyroid hormones, leading to a generalized slowing of metabolic processes. Its prevalence varies worldwide and is notably higher in females. Thyroid dysfunction can significantly affect renal function, commonly causing elevated serum creatinine levels, reduced glomerular filtration rate (GFR), and decreased renal plasma flow.⁶

The study included participants aged 21–45 years. The mean ages of the hypothyroid and control groups were 33.77 ± 0.62 years and 30.91 ± 6.87 years, respectively. Most hypothyroid participants were aged 31–40 years, while the majority of controls were in the 21–30 years range. These findings align with Chaudhury et al.⁹ who reported a predominant age group of 30–39 years with similar mean ages for cases and controls. Hypothyroidism was most frequent in the 25–35 years range, consistent with Rashead et al.¹⁰ and Arora et al.¹¹ also reported higher prevalence among individuals aged 21–40 years.

Regarding sex distribution, 6 males and 49 females were observed among cases, compared with 5 males and 50 females in controls. The higher prevalence in females is consistent with previous studies by Chaudhury et al.⁹ and Tejomani et al.¹² reflecting the known female predominance in hypothyroidism.

Mean serum creatinine levels were significantly higher in the hypothyroid group (0.926 mg/dL) than in controls (0.795 mg/dL), indicating the impact of thyroid dysfunction on renal physiology, including decreased renal plasma flow, impaired GFR, and reduced creatinine excretion. Similar findings were reported by Jayagopal et al.¹³ in newly diagnosed hypothyroid patients, as well as by

Tayal et al.¹⁴ and Sinisa et al.¹⁵ confirming that elevated creatinine occurs independently of other renal abnormalities or myopathy. In the present study, serum creatinine showed a weak positive correlation with T3 ($r=0.072$) and TSH ($r=0.154$) and a weak negative correlation with T4 ($r=-0.066$), none of which were statistically significant. Previous studies have reported mixed results: Tayal et al.¹⁴ and Tejomani et al.¹² observed significant negative correlations between creatinine and T3/T4, with positive correlations to TSH; Chaudhary et al. and Mamatha et al.¹⁶ reported positive correlations between TSH and creatinine; Jia et al.¹⁷ found weak negative correlations between TSH and creatinine, fT3, and fT4; while Kaur et al.¹⁸ reported a significant positive correlation between TSH and creatinine, but no association with fT3 or fT4. These findings highlight the variability in the relationship between thyroid function and renal parameters across different populations.

Limitation:

The study has several limitations. First, the case and control groups differed significantly in age distribution, which may have influenced the study outcomes. Second, as a single-center study, the findings may not be generalizable to the broader population. Third, the relatively small sample size, with a predominance of female participants, may further limit the external validity of the results. Finally, renal function was assessed using serum creatinine alone.

Conclusion:

In this study, individuals with hypothyroidism had significantly higher serum creatinine levels compared to healthy controls, indicating a potential impact of thyroid dysfunction on renal function. Correlation analysis showed no statistically significant association between serum creatinine and thyroid hormone levels (T3, T4, TSH) in hypothyroid patients. These findings suggest that hypothyroidism may elevate creatinine levels independently of circulating thyroid hormone concentrations.

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