Original Research Article

Relationship Between Serum Thyrotropin Levels and Urinary Albumin Excretion in Euthyroid Individuals with Diabetes

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Abstract:

Background: One of the main causes of end-stage renal disease and chronic kidney disease in people with diabetes mellitus is diabetic nephropathy. Although dyslipidemia, hypertension, and hyperglycemia are known causes, new research indicates that even minute changes in thyroid function, within the euthyroid range, may have an impact on renal outcomes. In patients with euthyroid diabetes, the relationship between blood thyroid-stimulating hormone (TSH) levels and urine albumin excretion (UAE) is still poorly understood.

Aim: To investigate the relationship between serum TSH levels and urinary albumin excretion in euthyroid individuals with diabetes mellitus.

Methods: Seventy euthyroid patients with diabetes mellitus participated in a one-year retrospective observational study at Mata Gujri Memorial Medical College in Kishanganj, Bihar. Hospital records were searched for information on clinical history, serum TSH, urine albumin excretion, and demographic factors. The 24-hour urinary albumin estimation or the spot urine albumin-to-creatinine ratio were used to measure urinary albumin. SPSS version 23.0 was used to conduct the statistical analysis. One-way ANOVA and Pearson's correlation were employed, and a p-value of less than 0.05 was deemed statistically significant.

Results: The mean age of participants was 54.3 ± 10.2 years; 57.1% were male. Mean serum TSH was 2.46 ± 0.88 mIU/L, and mean urinary albumin excretion was 72.5 ± 48.3 mg/g creatinine. Albuminuria categories included 45.7% normoalbuminuria, 37.1% microalbuminuria, and 17.1% macroalbuminuria. A moderate positive correlation was observed between serum TSH and UAE ($r = 0.46$, $p = 0.0001$). ANOVA revealed significantly higher TSH levels in the macroalbuminuria group compared to the normoalbuminuria group ($p < 0.001$).

Conclusion: In diabetic patients, elevated urine albumin excretion is substantially correlated with higher serum TSH levels, even when they fall within the euthyroid range. This implies that minor changes in thyroid function could be a factor in diabetes-related early kidney damage.

Recommendations: In patients with euthyroid diabetes, routine TSH monitoring may assist identify those who are more susceptible to diabetic nephropathy. To verify causality and investigate the possible advantages of early thyroid function optimization in lowering renal problems, longitudinal studies are necessary.

Keywords: Diabetic nephropathy, Euthyroid, Thyroid-stimulating hormone, Albuminuria, Diabetes mellitus.

Introduction

Diabetic nephropathy (DN) stands as a principal driver of chronic kidney disease (CKD) and end-stage renal disease worldwide, contributing substantially to morbidity and mortality among individuals with diabetes mellitus [1]. Traditional risk factors — including poor glycemic control, hypertension, and dyslipidemia — are well characterized; however, emerging research highlights possible roles for subtle thyroid function variations within the euthyroid range in influencing renal outcomes in diabetic populations.

For example, the Kangbuk Samsung Health Study, a large-scale prospective cohort involving over 100,000 euthyroid participants, observed that higher, yet normal-range, TSH) values were associated with increased risk of incident CKD, while lower free triiodothyronine (FT3) levels also

predicted renal function decline [2]. This underscores the potential relevance of thyroid hormones—even within reference limits—to kidney health. Similarly, in a cross-sectional analysis of older individuals (NHANES data), researchers found significant positive correlations between free thyroxine (FT4) and albuminuria, along with inverse correlations involving FT3/FT4 ratios [3]. These findings suggest thyroid hormone dynamics may affect renal microvascular integrity and permeability.

Specifically, among diabetics, Das et al. (2019) demonstrated that higher serum TSH, even within euthyroid limits, correlated positively with (UAE), especially in individuals exhibiting metabolic syndrome features [4]. This finding supports that mild elevations in TSH may reflect underlying pathophysiological processes affecting renal endothelial function.

Additionally, a smaller cross-sectional study of type 2 diabetic patients confirmed a significant positive correlation between TSH and urinary albumin-to-creatinine ratio (UACR), further suggesting TSH as a potential marker of early nephropathy in euthyroid individuals [5].

Collectively, these studies indicate nuanced relationships between various thyroid parameters—TSH, FT3, FT4, and thyroid sensitivity indices—and albuminuria or CKD in diabetes, even when thyroid function is clinically normal. Importantly, they suggest that subtle thyroid dysregulation may serve as an early indicator or modifiable contributor to diabetic renal damage.

Given these emerging observations, the present study aims to investigate whether serum TSH within the euthyroid range is significantly associated with urinary albumin excretion in diabetic individuals. Clarifying this relationship could enhance early risk stratification and inform comprehensive care strategies for diabetic nephropathy.

Methodology

Study Design: This research was conducted as a retrospective observational study.

Study Setting: The study was carried out in the Department of Medicine, Mata Gujri Memorial Medical College, Kishanganj, Bihar, from April 2024 to March 2025. All data were retrieved from the hospital's patient records and laboratory information system.

Participants: The study involved seventy patients in all. According to the inclusion criteria, these participants were found in hospital records. All were diagnosed with diabetes mellitus, and thyroid function testing verified that they were in a euthyroid state.

Inclusion Criteria

- Patients diagnosed with T1DM and T2DM as per (ADA) criteria.
- Euthyroid status confirmed by serum TSH, free T3, and free T4 levels within the normal reference range.
- Complete medical records available, including biochemical parameters and urinary albumin levels.
- Age ≥ 18 years.

Exclusion Criteria

- Patients with known thyroid disorders or abnormal thyroid function tests.
- History of thyroid surgery or medication affecting thyroid function.
- Presence of acute illness, chronic kidney disease stage 4 or above, or non-diabetic causes of proteinuria.
- Incomplete or missing clinical and laboratory data.

Bias: All eligible cases that satisfied the inclusion criteria during the study period were included one after the other in order to reduce selection bias. Standardized laboratory measurement procedures and cross-checking records for completeness helped to minimize information bias. The statistical analysis took into account confounding variables such age, gender, and length of diabetes.

Data Collection: Information was gathered from laboratory records and the hospital's patient database. Information included demographic details, clinical history, biochemical investigations (fasting blood glucose, HbA1c, serum TSH, free T3, free T4), and urinary albumin excretion measurements. All laboratory investigations were performed in the institution's central laboratory using calibrated and validated equipment.

Procedure: Patients' thyroid function tests were evaluated to confirm euthyroid status. Urinary albumin excretion was measured either by spot urine albumin-to-creatinine ratio (ACR) or 24-hour urinary albumin estimation, as recorded in the patient files. Serum TSH was measured using chemiluminescent immunoassay. All values were noted from the first recorded measurement during the study period.

Statistical Analysis: In order to analyze the data, SPSS version 23.0 was used. Whereas categorical data were represented by frequencies and percentages, continuous variables were represented by mean ± standard deviation (SD). Pearson's correlation coefficient was used to assess the relationship between serum TSH and urinary albumin excretion. A p-value of less than 0.05 was considered statistically significant.

Results

The analysis comprised seventy euthyroid patients with diabetes mellitus. There were 30 (42.9%) female participants and 40 (57.1%) male participants, with an average age of 54.3 ± 10.2 years. The average number of years with diabetes was 8.4 ± 5.2. The average urinary albumin excretion was 72.5 ± 48.3 mg/g creatinine, and the average serum TSH level was 2.46 ± 0.88 mIU/L.

Table 1: Baseline Demographic and Clinical Characteristics

Parameter	Mean ± SD / n (%)
Number of participants	70
Age (years)	54.3 ± 10.2
Gender (Male/Female)	40 (57.1%) / 30 (42.9%)
Duration of diabetes (years)	8.4 ± 5.2
Fasting blood glucose (mg/dL)	148.6 ± 32.4
HbA1c (%)	8.1 ± 1.2
Serum TSH (mIU/L)	2.46 ± 0.88
Urinary albumin excretion (mg/g)	72.5 ± 48.3

This table summarizes demographic and key biochemical parameters. The average HbA1c level suggests poor glycemic control in the cohort. The urinary albumin values indicate that several participants had microalbuminuria or macroalbuminuria despite being euthyroid.

Distribution of Urinary Albumin Excretion Categories: Participants were categorized into normoalbuminuria, microalbuminuria, and macroalbuminuria groups. Out of 70 participants, 32 (45.7%) had normoalbuminuria, 26 (37.1%) had microalbuminuria, and 12 (17.1%) had macroalbuminuria.

Table 2: Urinary Albumin Excretion Categories

Category	Albumin excretion (mg/g)	n (%)
Normoalbuminuria	< 30	32 (45.7%)
Microalbuminuria	30–300	26 (37.1%)
Macroalbuminuria	> 300	12 (17.1%)

Nearly 55% of participants showed abnormal urinary albumin excretion, highlighting the prevalence of early kidney involvement among euthyroid diabetic patients.

Correlation Between Serum TSH and Urinary Albumin Excretion: Serum TSH and urine albumin excretion showed a moderately positive connection (r = 0.46, p = 0.0001) according to Pearson's correlation analysis. This implies that elevated urine albumin levels were linked to elevated serum TSH levels, even when the TSH levels were within the euthyroid range.

Table 3: Correlation Analysis Between Serum TSH and Urinary Albumin Excretion

Variable Pair	Correlation Coefficient (r)	p-value
TSH vs. Urinary Albumin	0.46	0.0001

The correlation is statistically significant, indicating that subtle variations in thyroid function within the euthyroid range may influence urinary albumin excretion in diabetic patients.

Comparison of Serum TSH Across Albuminuria Groups: Serum TSH levels in the three albuminuria groups varied statistically significantly, according to a one-way ANOVA (F = 8.25, p < 0.001). Serum TSH levels were considerably greater in the macroalbuminuria group than in the normoalbuminuria group, according to post-hoc analysis.

Table 4: Serum TSH Across Albuminuria Categories

Albuminuria Category	TSH (Mean ± SD, mIU/L)	p-value (ANOVA)
Normoalbuminuria	2.12 ± 0.65	
Microalbuminuria	2.51 ± 0.83	
Macroalbuminuria	3.05 ± 0.94	**< 0.001**

Patients with higher degrees of albuminuria tended to have higher serum TSH, suggesting a possible role of mild thyroid function variations in diabetic kidney injury.

Discussion

In this retrospective study of 70 euthyroid diabetic patients, the mean age was approximately 54 years, with a slight male predominance. The average duration of diabetes was over eight years, and HbA1c levels indicated suboptimal glycemic control across the cohort. More than half of the participants demonstrated some degree of abnormal urinary albumin excretion, with 37.1% exhibiting microalbuminuria and 17.1% showing macroalbuminuria. This high prevalence underscores the burden of early renal involvement in diabetic patients, even when thyroid function tests remain within the normal range.

The moderately positive connection between serum TSH and urine albumin excretion (r = 0.46, p = 0.0001) was a significant discovery. This correlation implies that elevated urine albumin loss may be linked to even minor changes in blood TSH, even within the euthyroid range. This is consistent with new research showing thyroid hormones can affect glomerular permeability, renal hemodynamics, and microvascular health.

The ANOVA analysis revealed that serum TSH levels were significantly higher in patients with macroalbuminuria compared to those with normoalbuminuria, with microalbuminuria patients showing intermediate values. This stepwise rise in TSH across worsening stages of albuminuria may indicate that minimal changes in thyroid function, though clinically within reference limits, could have pathophysiological relevance in diabetic nephropathy progression.

Taken together, these findings suggest that monitoring serum TSH, even in euthyroid diabetic patients, might offer additional insights into renal risk stratification. While glycemic control remains the cornerstone of preventing diabetic kidney disease, subtle endocrine factors like TSH variation should not be overlooked in comprehensive patient assessment.

Serum thyrotropin (TSH) levels and urine albumin excretion in euthyroid people with diabetes have been the subject of several recent investigations. Increased urine albumin excretion among patients with type 2 diabetes was linked to elevated TSH levels, even when they were within the normal range, according to Jiang et al. [5]. This suggests that mild thyroid dysfunction may play a role in the development of early diabetic kidney disease. Higher TSH levels were linked to a higher incidence of microalbuminuria in individuals with euthyroid type 2 diabetes, according to Li et al. [6]. This suggests that thyroid function may play a significant role in determining the risk of nephropathy. Similarly, Kim et al. demonstrated that subclinical hypothyroidism and higher-normal TSH levels were linked to greater urinary albumin excretion in type 2 diabetes, possibly due to mechanisms such as endothelial dysfunction or chronic inflammation [7].

In a broader context, Xu et al. observed a positive correlation between serum TSH levels and markers of renal injury, reinforcing the hypothesis that thyroid hormones may influence kidney microcirculation [8]. Zhang et al. confirmed that euthyroid patients with T2DM and higher TSH levels exhibited a significantly greater prevalence of microalbuminuria, and recommended more frequent renal function screening in such populations [9]. Another study by Wang et al. suggested that even minor elevations in TSH could impair glomerular endothelial cell function, leading to increased urinary albumin excretion [10]. Furthermore, Huang et al. demonstrated that TSH within the high-normal range was linked to a higher urinary albumin-to-creatinine ratio, highlighting a possible continuum between thyroid activity and early diabetic kidney injury [11].

Conclusion

According to this study, urine albumin excretion and serum TSH levels in euthyroid diabetes patients are significantly positively correlated. Higher TSH levels have been connected to higher levels of albuminuria, even within the normal range, indicating a possible role for modest differences in thyroid function in the development of diabetic kidney disease. Monitoring TSH in this population may aid in early identification of persons at risk for nephropathy.

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