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Original Research Article

Assessment of Thyroid Function in Patients of Chronic Kidney Disease in Tertiary Care Hospital

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Abstract:

Background: Chronic kidney disease (CKD) is a growing global health problem associated with multiple systemic complications, including thyroid dysfunction. Altered thyroid hormone metabolism in CKD may worsen renal and cardiovascular outcomes yet remains under-recognized.

Aim: To assess thyroid function in patients with CKD attending a tertiary care hospital and evaluate its association with CKD stage, renal parameters, and comorbidities.

Methodology: This retrospective cross-sectional study included 160 adult CKD patients. Data on renal function tests and thyroid profile (TSH, FT3, FT4) were collected from hospital records. CKD staging was based on KDIGO guidelines. Statistical analysis was performed using SPSS version 20.0, with $p < 0.05$ considered significant.

Results: Thyroid dysfunction, predominantly hypothyroidism, was significantly associated with advancing CKD stages (T3 p=0.041; T4 p=0.038; TSH p=0.047). Hypothyroidism based on TSH was observed in 14.4% of patients, while hyperthyroidism was rare (1.3%). Altered TSH levels were significantly associated with lower GFR (p=0.043), reduced serum albumin (p=0.003), and elevated BUN (p<0.001). A significant association was found between hypothyroidism and cardiovascular disease (p=0.012).

Conclusion: Thyroid dysfunction, particularly hypothyroidism, is common in advanced CKD and correlates with worsening renal function and cardiovascular disease, emphasizing the need for routine thyroid evaluation in CKD patients.

Keywords: Chronic Kidney Disease, Thyroid Dysfunction, Hypothyroidism, TSH, Glomerular Filtration Rate, Cardiovascular Disease.

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Introduction

Chronic kidney disease (CKD) has become one of the major public health issues in the whole world with its prevalence and incidence continually rising in the past decade or so. Statistics on CKD prevalence in the United States have shown that the prevalence is about 11.7% as per the data brought by National Health and Nutrition Examination Survey [1]. On the same note, CKD is a significant and an increasing health burden in the Kingdom of Saudi Arabia. It is approximate that almost 20,000 patients are already under dialysis treatment, and 9,810 kidney transplant patients are under regular follow-ups. Age-specific prevalence of CKD in Saudi Arabia has been stated to be 9,892 per 100,000 inhabitants (stages 1–5), without persons receiving renal replacement therapy. This is higher than the one in Western Europe (5,446 per 100,000) and North America (7,919 per 100,000). These data help to highlight the scale of CKD as a healthcare issue at a national and international level, and it is necessary to thoroughly examine its systemic complications.

CKD is a progressive, irreversible disease, which is associated with gradual destruction of the renal structure and functioning, and eventually with the disruption of excretory, synthetic, and metabolic functions of the kidneys [2]. The definitions and classification systems of CKD have over the years developed to enhance early detection and management. Under the current international guidelines, CKD is considered as a glomerular filtration rate (GFR) of below 60 mL/min/1.73 m 2 during a minimum span of three months or even the existence of indicators of kidney damage, including albuminuria or proteinuria, which continues through the same period of time [3]. Unremitting and progressive nature

of CKD exposes patients to various systemic complications, which involve cardiovascular, endocrine, hematologic, and metabolic systems. Thyroid dysfunction is one of them, and it has acquired more and more attention because of its insidious nature and possible consequences of morbidity and mortality.

Thyroid gland is critical in maintaining homeostasis of metabolism by secretion of triiodothyronine (T3) and thyroxine (T4) hormones, which are necessary in controlling the metabolism, protein synthesis, growth, and tissue differentiation. The thyroid hormones affect almost all organ systems such as the cardiovascular system and the renal system. The changes in the metabolism of thyroid hormones are common in CKD patients. There are also clinical signs of dysfunction of the thyroid gland like fatigue, edema, dyphoria, and dizziness that are commonly seen in patients with CKD [4]. Overlapping of these two conditions can lead to under-diagnosis and late treatment of hypothyroidism among the vulnerable population [5]. As a result, thyroid dysfunction cannot be detected unless it is explicitly examined, which is why regular evaluation is a crucial procedure in CKD patients.

There are complicated mechanisms of CKD on thyroid functions. These are a drop in the peripheral conversion of T4 to T3, decline in the levels of thyroid hormone in the circulation, a decrease in the ability to bind to the carrier proteins, retention of more iodine, and a change in the responsiveness of the tissues to the thyroid hormones. It is also noteworthy that although the low T3 and T4 levels in CKD patients are frequently accompanied by a lack of corresponding rise in serum thyroid-stimulating hormone (TSH), such an increase may indicate the change in the regulation of hypothalamic-pituitary-thyroid axis in uremia. On the other hand, CKD patients who develop hyperthyroidism show acceptable suppressions of TSH levels [6]. These changes indicate that care should be taken when interpreting thyroid functionality tests in CKD since the test similarly demands close clinical association.

Besides the effect of CKD on thyroid functioning, other thyroid disorders are also capable of fueling the onset and the development of renal dysfunction. Decreased renal blood flow, GFR, and poor tubular functions have been linked to a reduction in the circulating iodothyronines that cause a reduction in water excretion. These modifications can also worsen renal dysfunction. Moreover, inflammation has been cited as a major mediator between CKD and thyroid abnormalities. Chronic inflammation is a typical feature of CKD, and contributes greatly to the pathogenesis of thyroid dysfunction, and other stress-related disorders like sepsis and malnutrition [7].

Thyroid dysfunction in CKD has a wide range of clinical implications that go beyond metabolic imbalance. Lower GFR level patients are more prone to cardiovascular morbidity and mortality. This risk can be increased by hypothyroidism, which causes dyslipidemia, endothelial and myocardial dysfunction, and may result in atrial fibrillation, heart failure and ischemic heart disease [8]. Seeing that the cardiovascular disease is the most frequent cause of mortality in CKD patients, the unidentified or unnoticed thyroid dysfunction could be a substantial factor in patient outcomes.

A number of studies have been done to explore the prevalence of thyroid dysfunction in patients with CKD. At one month of a cross-sectional study on patients with stage 5 CKD, it was shown that 74.5% of the population was euthyroid, 24.4% hypothyroid and 3.3% subclinical hyperthyroid [9]. Thyroid nodules and cysts were also found in Khartoum as the second most frequent result in the CKD patients undergoing hemodialysis with thyroid goiter being reported in 21.57% [10] B. These results suggest that there is a significant poly of thyroid malfunctions in end stage renal disease.

In India, the information about thyroid dysfunction among CKD patients is rather scarce but significant. The Nephrology Division of the Security Forces Hospital studied 255 CKD patients in a cross-sectional study in the period between January 2015 and February 2018. Among them, 166 were of normal thyroid, 43 of subclinical hypothyroidism, and 46 of overt hypothyroidism. In general, it was found that 34.9% of CKD patients were hypothyroid, with or without dialysis, and 17.66% did not qualify [11]. A different study by Al Jabr Kidney Center in 2022 on 99 patients established that 5.1% of them had elevated TSH levels, 9.1% had low TSH levels, and the rest (85.9) were euthyroid. These results indicate that prevalence rates vary and could be determined by the characteristics of patients, CKD stage, dialysis, and study design.

Although CKD prevalence in Saudi Arabia is high and rising, there is limited and no exhaustive information on the evaluation of thyroid functions among CKD patients in tertiary care facilities. Due to the similarity of clinical presentations of CKD and thyroid disorders, and the possible consequences of thyroid impairment on cardiovascular events and morbidity in general, a systematic assessment of thyroid functions in patients with CKD is necessary. Thyroid abnormalities can be managed, and early detection would result in better quality of life and fewer complications.

Thus, the proposed research will evaluate thyroid activity in chronic kidney disease patients who visit a tertiary care hospital and examine the correlation between CKD and changes in thyroid hormones. Understanding this association will provide valuable insights for clinicians in optimizing the comprehensive management of patients with impaired renal

function and contribute to improved patient outcomes.

Methodology

Study Design: This hospital-based retrospective cross-sectional observational study was conducted to assess thyroid function in patients diagnosed with chronic kidney disease (CKD). The study involved analysis of existing patient records and laboratory data to evaluate the prevalence and pattern of thyroid dysfunction among CKD patients.

Study Area: The study was conducted in the Department of Biochemistry at Anugrah Narayan Magadh Medical College and Hospital, Gaya ji, Bihar, India

Study Duration: The study was carried out over a period of seven months from March 2025 to September 2025.

Study Population: The study population comprised adult patients diagnosed with chronic kidney disease who attended the tertiary care hospital and had undergone renal and thyroid function testing. Patients were identified from hospital medical records and laboratory databases maintained in the Department of Biochemistry.

Sample Size: A total of 160 patients diagnosed with chronic kidney disease who fulfilled the inclusion criteria were included in the study. The sample size was determined based on the availability of complete medical and laboratory records during the study period.

Data Collection: Data were collected retrospectively from hospital records and the biochemistry laboratory database using a structured data collection sheet prepared in Microsoft Excel. Demographic variables such as age, gender, and body mass index (BMI) were recorded. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2) and classified according to World Health Organization criteria.

Clinical and laboratory parameters collected included renal function tests such as serum creatinine, blood urea nitrogen (BUN), estimated glomerular filtration rate (eGFR), and urine albumin-to-creatinine ratio. Thyroid function tests included serum thyroid stimulating hormone (TSH), free triiodothyronine (FT3), and free thyroxine (FT4). Additional biochemical parameters such as fasting blood glucose, HbA1c, serum electrolytes (sodium, potassium, and calcium), serum albumin, gamma globulin, and complete blood count were also recorded. CKD staging was done according to Kidney Disease: Improving Global Outcomes (KDIGO) guidelines based on eGFR values and classified into stages 1 to 5.

Thyroid status was categorized based on biochemical reference ranges. Euthyroidism was defined as TSH levels between 0.6 and 5.5 mIU/L, FT4 between 9 and 19 pmol/L, and FT3 between 2.3 and 4.1 pg/mL. Hypothyroidism was defined as elevated TSH levels (>5.5 mIU/L) with low FT3 and/or FT4 levels, while hyperthyroidism was defined as low TSH levels with elevated FT3 and/or FT4 levels.

Inclusion Criteria

- Patients aged ≥18 years
- Diagnosed cases of chronic kidney disease (any stage 1–5 as per KDIGO guidelines)
- Patients with available thyroid function test reports (TSH, FT3, FT4)
- Patients with complete renal function test records

Exclusion Criteria

- Patients with previously diagnosed primary thyroid disorders
- Pregnant women
- Patients on medications affecting thyroid function (e.g., amiodarone, lithium, steroids)
- Patients with acute kidney injury (AKI)
- Patients with chronic liver disease, malignancy, or other severe systemic illness
- Patients undergoing dialysis (hemodialysis or peritoneal dialysis)
- Patients with incomplete or missing laboratory data

Study Procedure: Eligible patient records were identified from hospital databases. Relevant demographic and laboratory data were extracted and entered into a structured Excel sheet. CKD stages were determined based on eGFR values, and thyroid function status was classified according to predefined biochemical criteria. The collected data were carefully cross-verified for accuracy before being subjected to statistical analysis.

Statistical Analysis: Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation for normally distributed data. The Chi-square test or Fisher's exact test was applied to assess associations between categorical variables, such as CKD stage and thyroid dysfunction. The independent sample t-test was used to compare means between groups. Correlation analysis using Pearson's or Spearman's method was performed to evaluate the relationship between thyroid hormone levels and renal function parameters. A p-value of less than 0.05 was considered statistically significant."

Result

Table 1 illustrates the distribution of CKD patients across stages according to thyroid profile (N = 160).

A significant association was observed between CKD stage and T3 levels (p = 0.041), with T3 hypothyroidism more frequently seen in advanced stages, particularly Stage 5 (35.0%) and Stage 3 (30.0%). Similarly, T4 hypothyroidism showed a significant association with CKD stage (p = 0.038), being most prevalent in Stage 5 (43.8%) and Stage 3 (31.3%). Regarding TSH levels, a statistically significant relationship was also found (p = 0.047). TSH hypothyroidism was most common in Stage 3 (39.1%) and Stage 4 (21.7%), while hyperthyroidism was rare (1.3%) and observed only in Stages 3 and 5. Overall, thyroid dysfunction—particularly hypothyroidism—was more common in the later stages of CKD, indicating a significant association between worsening renal function and altered thyroid profile.

Table 1: Distribution of CKD patients according to stages and thyroid profile (N = 160)

Thyroid profiles	Stages of CKD						
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total	p-value
T3 level							
Hypothyroidism (n, %)	1 (5.0)	2 (10.0)	6 (30.0)	4 (20.0)	7 (35.0)	20 (12.5)	0.041
Euthyroidism (n, %)	19 (15.2)	18 (14.4)	35 (28.0)	22 (17.6)	31 (24.8)	125 (78.1)	
T4 level							
Hypothyroidism (n, %)	0 (0.0)	1 (6.3)	5 (31.3)	3 (18.8)	7 (43.8)	16 (10.0)	0.038
Euthyroidism (n, %)	20 (15.6)	19 (14.8)	38 (29.7)	23 (18.0)	28 (21.9)	128 (80.0)	
TSH level							
Hyperthyroidism (n, %)	0 (0.0)	0 (0.0)	1 (50.0)	0 (0.0)	1 (50.0)	2 (1.3)	0.047
Euthyroidism (n, %)	18 (14.1)	16 (12.5)	34 (26.6)	21 (16.4)	27 (21.1)	116 (72.5)	
Hypothyroidism (n, %)	2 (8.7)	4 (17.4)	9 (39.1)	5 (21.7)	3 (13.1)	23 (14.4)	

Table 2 shows the association between TSH status and renal function parameters among 160 participants. A statistically significant difference in GFR was observed across thyroid groups (F = 3.212, p = 0.043), with the lowest mean GFR seen in hyperthyroid patients (24.5 ± 10.21 mL/min/1.73 m²), followed by hypothyroid (32.8 ± 18.67), while euthyroid patients had comparatively higher GFR (41.2 ± 22.35). Serum creatinine levels were higher in hyperthyroid (3.8 ± 1.6 mg/dL) and hypothyroid (3.3 ± 1.7 mg/dL) groups compared to euthyroid patients (2.9 ± 1.8 mg/dL), though this difference did not reach statistical significance (p = 0.058). Serum albumin levels differed significantly among groups (F = 6.118, p = 0.003), being highest in euthyroid patients (3.9 ± 0.5 g/dL) and lower in both hyperthyroid (3.4 ± 0.3) and hypothyroid (3.5 ± 0.6) groups. Blood urea nitrogen (BUN) levels also showed a highly significant difference (F = 8.944, p < 0.001), with markedly elevated values in hyperthyroid (78.6 ± 25.4 mg/dL) and hypothyroid (58.3 ± 20.6 mg/dL) patients compared to euthyroid individuals (46.2 ± 18.7 mg/dL). Overall, altered TSH levels were significantly associated with impaired renal function, particularly in terms of GFR, serum albumin, and BUN.

Table 2: Association between TSH level and renal function tests (N = 160)

Renal Function Tests	TSH Status	Mean	SD	95% CI	F	p-value
GFR (mL/min/1.73 m²)	Hyperthyroidism (n=2)	24.5	10.21	11.4–37.6	3.212	0.043
	Euthyroidism (n=116)	41.2	22.35	37.1–45.3		
	Hypothyroidism (n=23)	32.8	18.67	25.2–40.4		
Serum Creatinine (mg/dL)	Hyperthyroidism	3.8	1.6	1.2–6.4	2.904	0.058
	Euthyroidism	2.9	1.8	2.6–3.2		
	Hypothyroidism	3.3	1.7	2.6–4.0		
Serum Albumin (g/dL)	Hyperthyroidism	3.4	0.3	2.9–3.9	6.118	0.003
	Euthyroidism	3.9	0.5	3.8–4.0		
	Hypothyroidism	3.5	0.6	3.2–3.8		
BUN (mg/dL)	Hyperthyroidism	78.6	25.4	42.2–115.0	8.944	<0.001
	Euthyroidism	46.2	18.7	42.8–49.6		
	Hypothyroidism	58.3	20.6	49.5–67.1		

Table 3 demonstrates the association between TSH status and various comorbid conditions among 160 participants. A statistically significant association was observed between thyroid status and cardiovascular disease (CVD) (p = 0.012), with hypothyroidism being more prevalent among patients with CVD (45.0%) compared to those without CVD (20.0%). In contrast, no significant associations were found

between thyroid status and Type 1 diabetes (p > 0.99), Type 2 diabetes (p = 0.321), hypertension (p = 0.417), or dyslipidemia (p = 0.506). Across most comorbidities, euthyroidism remained the most common thyroid status, while hyperthyroidism was relatively rare. Overall, only CVD showed a significant relationship with altered TSH levels, particularly hypothyroidism.

Table 3: Association between TSH level and comorbid conditions (N = 160)

Condition	Hyperthyroidism n (%)	Euthyroidism n (%)	Hypothyroidism n (%)	p-value
CVD				
No (n=120)	1 (0.8)	95 (79.2)	24 (20.0)	0.012
Yes (n=40)	1 (2.5)	21 (52.5)	18 (45.0)	
Type 1 DM				
No (n=156)	2 (1.3)	113 (72.4)	41 (26.3)	>0.99
Yes (n=4)	0 (0.0)	3 (75.0)	1 (25.0)	
Type 2 DM				
No (n=70)	0 (0.0)	54 (77.1)	16 (22.9)	0.321
Yes (n=90)	2 (2.2)	62 (68.9)	26 (28.9)	
Hypertension				
No (n=50)	0 (0.0)	38 (76.0)	12 (24.0)	0.417
Yes (n=110)	2 (1.8)	78 (70.9)	30 (27.3)	
Dyslipidemia				
No (n=65)	1 (1.5)	48 (73.8)	16 (24.6)	0.506
Yes (n=95)	1 (1.1)	68 (71.6)	26 (27.4)	

Discussion

The current investigation indicated that thyroid dysfunction is significantly related to the progressive course of CKD, and hypothyroidism is more frequent with the decrease in the renal functioning. In general, T3-based hypothyroidism was found in 12.5% of the patients, with the largest percentage of 35.0 in Stage 5, 30.0 in Stage 3 and 20.0 in Stage 4 (p = 0.041). These results are consistent with the study conducted by Gupta et al. (2018) [12] who found that there was a strong decrease in the number of FT3 with the progression of CKD, and 30.8% of patients in Stage 5 showed hypothyroidism and statistically significant correlation (p = 0.007). Equally, Yuasa et al. (2020) [5] found that there was more common prevalence of hypothyroidism in the Japanese CKD patients, especially those in the most advanced stages, which supported the progressive reduction of thyroid hormones due to deteriorating renal dysfunction. Nonetheless, contrary to our observation of a plateau in Stage 5, other studies have identified a lineal rise without troughs between Stages 3 and 4, which might be due to regional, nutritional, or dialysis-specific factors (Volkova et al., 2019) [13]."

T4-based hypothyroidism occurred in 10.0% of patients in our cohort and rose significantly in Stage 5 (43.8%), and not at all in Stage 1 (p = 0.038). Similar findings were made by Alshammari et al. (2019) who established that the prevalence of hypothyroidism increases significantly with a decrease in the estimated GFR, especially in the late CKD stages [11]. In a similar manner, Chandra (2016) [14] reported the incidence of overall hypothyroidism in CKD patients as about 24% and better in patients with severe renal impairment. Even though our total rate of hypothyroidism using a combination of parameters (20.5 percent) is a little lower than the rate of 26.66 percent in the same group of undialyzed CKD patients as reported by Srivastava et al. (2018) [7], both articles have shown a uniform increasing tendency of thyroid dysfunction with the advancement of CKD. Minor differences in prevalence might be due to differences in sample size, dialysis status, and trends in iodine intake.

Regarding TSH, 14.4% of our patients contained hypothyroidism and 1.3% contained hyperthyroidism (p = 0.047), and with Stage 3 had the highest percentage of TSH-based hypothyroidism (39.1). This tendency is partly in line with the results of Singh et al. (2016) [15], who found a huge percentage of subclinical hypothyroidism in the patient group with CKD and emphasized the changes in TSH dynamics in moderate-to-advanced CKD. Interestingly, although we have reported the highest TSH abnormality in Stage 3, other studies including Yuasa et al. (2020) [5] reported a gradual rise to Stage 5. This difference can be due to temporary adaptive alterations in the hypothalamic pituitary thyroid axis in intermediate stages of CKD or variation in inflammatory load and exposure to dialysis.

Our study also supports the evidence of a bidirectional relationship by the fact that thyroid status and renal functional parameters of the body are associated. We have noted that the mean GFR of the hyperthyroid (24.5 and 10.21 mL/min/1.73 m 2) and the hypothyroid (32.8 and 18.67 mL/min/1.73 m 2) patients were lowest than that of the euthyroid individuals (41.2 and 22.35 mL/min/1.73 m 2). The same results were also detected in the German

Chronic Kidney Disease study by Schultheiss et al. (2021) [16] that revealed the presence of a significant linear association between low GFR and low levels of T3 and T4 with thyroid dysfunction predicting negative renal outcomes. Similarly, a large positive correlation between eGFR and FT3/FT4 was reported by Galeti et al. (2022) [17] in Southern India, which supports the idea that a decrease in renal functionality is accompanied by a decline in thyroid hormone levels. These findings are consistent with our findings, which support the hypothesis that minimized peripheral conversion of T4 to T3 and poor metabolism of hormones take place as the kidney function declines.

In the case of biochemical parameters, we discovered that TSH status had a strong correlation with BUN ($p < 0.001$), where hyperthyroid patients had the highest means of BUN (78.6 ± 25.4 mg/dl), then hypothyroid ones (58.3 ± 20.6 mg/dl), and finally euthyroid (46.2 ± 18.7 mg/dl). Similar results were also found by Singh et al. (2016) who found a vastly high level of blood urea in CKD patients with thyroid dysfunction as compared to controls ($p < 0.0001$) [15]. Even though there is some literature that indicates that BUN levels decrease in hypothyroidism since there is less protein catabolism, we have found that in CKD, the effects of renal impairment may have a higher impact than the effects of metabolism do. Also, the levels of serum albumin were found to be significantly lower in hypothyroid (3.5 ± 0.6 g/dL) and hyperthyroid (3.4 ± 0.3 g/dL) compared to the euthyroid (3.9 ± 0.5 g/dL) ($p = 0.003$), which is also compatible with previous reports that low levels of albumin in CKD are a possible result of malnutrition-inflammation complex syndrome and that commonly accompanies thyroid disease (Iglesias & D

There is also evidence that the significant correlation of hypothyroidism with cardiovascular disease in our study ($p = 0.012$) is supported by evidence. We found that CVD patients of CKD were 45.0% hypothyroid as compared to 20.0% of CKD patients without CVD. Such a situation can be compared to the results obtained by Srivastava et al. (2018) [7], who have found that CKD patients with abnormal thyroid profiles had a greater cardiovascular morbidity. The deficiency of thyroid hormones has the potential to impair the heart output, elevate the vessels resistance in the body, and hasten the process of atherosclerosis, thus worsening the risk of cardiovascular disease in CKD. Conversely, we did not observe any significant correlations between TSH levels and diabetes, hypertension, or dyslipidemia, like Alshammari et al. (2019) did [11], which may indicate that thyroid dysfunction in CKD may be more directly connected to renal dysfunction and cardiovascular pathophysiology than to conventional metabolic comorbidities.

All in all, our results are consistent with the regional and global statistics that reveal that thyroid dysfunction, specifically, hypothyroidism and low T3 syndrome, is gaining momentum in severe CKD. Although there are some small differences in prevalence rates among studies, the uniformity of the correlation between the decreasing GFR and the thyroid hormone changes demonstrates the need to conduct thyroid functional evaluation regularly in patients diagnosed with CKD and primarily in the tertiary care environment that addresses the end-stage illness.

Conclusion

This paper has shown that thyroid dysfunction is closely related to the severity of chronic kidney disease, and that abnormalities of T3, T4, and TSH levels are more common in later stages of CKD. The prevalence of thyroid disorder was hypothyroidism followed by hyperthyroidism that was relatively low. Thyroid dysfunction showed a significant relationship with declining renal function, particularly glomerular filtration rate, serum albumin, and blood urea levels, suggesting a close interplay between thyroid status and kidney impairment. Additionally, a significant association was found between thyroid dysfunction and cardiovascular disease, whereas no significant association was observed with diabetes, hypertension, or dyslipidemia. These findings highlight the importance of routine assessment of thyroid function in patients with CKD in tertiary care settings to facilitate early detection and appropriate management of thyroid abnormalities, which may influence overall disease progression and patient outcomes.

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