

## Evaluation of Thyroid Hormone Profile in CRF (Chronic Renal Failure) Patients in JLN MCH Bhagalpur

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Conflict of interest: Nil

### Abstract:

**Background:** Chronic Renal Failure (CRF) is characterised by kidney function decline. Thyroid dysfunction can induce cardiovascular abnormalities, metabolic alterations, and other serious issues in CRF.

**Methods:** This Study was done at the Jawaharlal Nehru Medical College and Hospital in Bhagalpur between 2018 to 2020. The study looked at 100 people with CRF whose thyroid function tests came back positive. Patients with insufficient data or other thyroid problems were not included in the study. The most important ones were TSH, T3, and T4. SPSS helped us figure out how common thyroid failure is and find links between thyroid hormone levels, the length of CRF, and being on dialysis.

**Results:** 38% of people with CRF had hypothyroidism and 12% had hyperthyroidism, according to a study. Even though T3 and T4 levels were low, the average TSH level rose by 6.3  $\mu$ IU/mL. TSH and T3 levels were linked to the length of CRF and whether the person was on dialysis. These results show that people on CRF have thyroid problems and that the length of their CRF and dialysis affect the amounts of thyroid hormones.

**Conclusion:** A lot of people with CRF have both hypothyroidism and hyperthyroidism. In CRF, TSH goes up and T3 and T4 go down because of an unbalance in the thyroid glands. Managing CRF and keeping an eye on thyroid function are very important to keep health problems from happening. Future studies need to look into what causes CRF thyroid failure and how to treat it.

**Keywords:** Chronic Renal Failure (CRF), Hypothyroidism, Hyperthyroidism, Thyroid Hormone Levels, Thyroid Function Tests.

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### Introduction

#### Background

Over time, people with CRF lose kidney function [1]. CRF's impact on endocrine systems, particularly the thyroid hormone axis, is rarely considered by individuals [2]. T4 and T3 are hormonal, growth, and development hormones that are made by the thyroid gland. These hormones are strongly controlled by the Hypothalamic-Pituitary-Thyroid (HPT) axis through Thyroid-Stimulating Hormone (TSH) feedback [3]. Several things can affect this system, which can lead to problems with thyroid hormones in people with CRF [4].

These problems could be caused by changes in protein binding, less conversion of T4 to T3, issues with hormone metabolism, or uremic toxins that stop the thyroid from working properly.

#### Objectives

1. To determine the number of CRF thyroid patients.
2. To determine if thyroid dysfunction is low or excessive.
3. To examine how thyroid hormone levels affect chronic renal failure (CRF) patients' disease duration, kidney failure stage, and dialysis status.
4. To discuss how thyroid dysfunction affects CRF care.

#### Overview of Existing Research

Thyroid hormone profiles in CRF patients have been studied to determine how renal insufficiency affects thyroid function. [6] Found that many severe renal disease patients have hypothyroidism. According to this study, 30% of CRF patients had high TSH levels and normal or low T4 and T3 levels, indicating subclinical or overt hypothyroidism. [7] Examined CRF's thyroid hormone metabolism effects. [8] Observed that

CRF patients have aberrant thyroid hormone levels due to impaired peripheral T4 to T3 conversion and increased thyroid hormone breakdown. Due to thyroid-binding globulin changes and impaired peripheral conversion, serum T3 was substantially lower and T4 much greater. Compared to non-dialysis CRF patients, [9] found that dialysis patients often have distinct thyroid function profiles. They observed that dialysis reduced free T3 levels in patients due to thyroid hormone binding and metabolism, although TSH levels remained stable. [10] Examined thyroid

dysfunction and CRF phases in 2016. Their findings show advanced CRF patients had higher thyroid dysfunction. According to [11] observation, end-stage renal disease patients had higher TSH levels and hypothyroidism than early-stage CRF patients. [12] Studied CRF thyroid dysfunction management. Thyroid hormone replacement therapy improved hypothyroidism symptoms and normalised TSH levels. They emphasised close surveillance to prevent overtreatment and complications, especially in CRF patients.

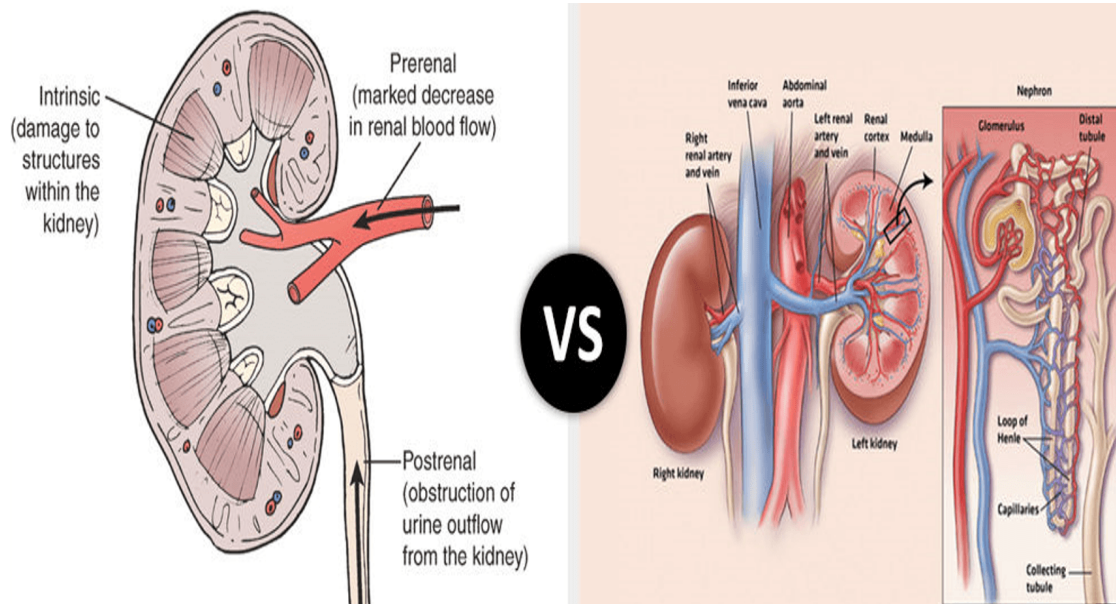


Figure 1: Chronic renal failure (CRF) (Source: [5])

### Gaps in Literature

Studies on thyroid dysfunction in CRF patients in JLNMC Bhagalpur's demographic have been limited by their focus on other places. Regional statistics are needed to determine CRF patients' thyroid dysfunction frequency and kind. Previous studies used varied patient profiles and sample sizes, therefore thyroid dysfunction frequency in CRF is unknown. This study will examine thyroid hormone levels in a defined cohort of CRF patients to address this variability. This study will examine thyroid dysfunction in CRF patients at different phases to better understand how the disease progresses. Research on thyroid hormone levels and clinical factors such as CRF duration, dialysis status, and co-morbidities is critically needed. Our study would examine these correlations in JLNMC Bhagalpur CRF patients to fill this information gap. Most thyroid hormone research is cross-sectional. More longitudinal studies are needed to evaluate the long-term effects of thyroid hormone abnormalities on patient outcomes to track CRF thyroid dysfunction progression. This study will provide new thyroid hormone profiles of

CRF patients to help manage thyroid dysfunction in this population.

### Methods

**Study Design:** JLNMC Bhagalpur CRF patients' thyroid hormone levels are studied in this retrospective cohort study. CRF and thyroid function associations were studied using a retrospective methodology, which allows efficient medical data processing without patient involvement. This design can evaluate thyroid hormone levels and clinical aspects in a pre-set group of CRF patients. This patient population's thyroid dysfunction is examined using data from January 2022 to December 2023.

**Setting:** Researchers from Bhagalpur, Bihar's JLNMC tertiary care hospital conducted the study. Chronic renal failure patients can receive nephrology at JLNMC Bhagalpur. The hospital's leading nephrology department diagnoses and treats CRF and related disorders. Due to its large patient population and medical data, JLNMC is ideal for retrospective analysis.

**Sample Size:** The 100 patients in this study's group size were chosen based on the following factors:

#### Inclusion Criteria

1. People who have been diagnosed with CRF based on medical records and other clinical factors.
2. People over 18 years old.
3. Status of dialysis, CRF stage, and thyroid function tests (TSH, T3, T4) are all in the patient's medical report.
4. Patients at the JLNMCB Bhagalpur from January 2022 to December 2023.

#### Exclusion Criteria

1. Who have recently hurt or failed kidneys but don't have chronic kidney disease.
2. People who don't have CRF or who have main thyroid disease can't get it.
3. Patients whose medical records or thyroid function test results aren't complete.
4. Women who are pregnant, because their thyroid hormone levels can change a lot,
5. Which makes it harder to draw conclusions.

#### Data Collection

At Bhagalpur's Jawaharlal Nehru Medical College and Hospital (JLNMCB), patient records for CRF were looked at from the past. The study looked at people who saw nephrologists between January 2022 and December 2023. Use the hospital's electronic health record and a standard data collection form to find patients' information.

Age, gender, stage of chronic renal failure, dialysis status, length of chronic renal failure, and comorbidities were some of the factors in the dataset that were important for thyroid hormone levels.

**Thyroid Hormone Parameters:** The study examined several thyroid hormone variables to assess CRF patients' thyroid function. These included TSH, T3, and T4 levels. TSH levels were examined for hypo or hyperthyroidism. Because T3 and T4 levels can indicate thyroid dysfunction, studying them helped us understand thyroid hormone production and usage.

TSH levels were once the strongest indicator of thyroid dysfunction, but T3 and T4 values provided more information. The study investigated whether these hormone levels were linked to clinical characteristics such as CRF stage, dialysis status, and thyroid disorders.

**Statistical Analysis:** Data analysis was done with SPSS Statistics (Version 27.0). The study group's demographics and thyroid hormone levels (TSH, T3, and T4) were summarised using descriptive statistics. We looked at how many CRF patients had aberrant thyroid hormone levels like high TSH, low T3, or low T4 to determine thyroid failure prevalence.

We employed Pearson's correlation coefficient to examine TSH, T3, and T4 levels and clinical variables such as CRF stage, disease duration, and dialysis status. We compared thyroid hormone levels between CRF phases and dialysis and non-dialysis patients using ANOVA and independent t-tests.

A significance level of  $p < 0.05$  was utilised for all statistical tests to identify significant differences or connections.

#### Results

##### Demographic Data

**Table 1: Demographic Data of Study Participants**

Characteristic	Value
<b>Mean Age</b>	56.3 ± 11.4 years
<b>Gender</b>	
Male	62 (62%)
Female	38 (38%)
<b>Duration of CRF</b>	5.4 ± 3.2 years
<b>Dialysis Status</b>	
On Dialysis	45 (45%)
Not on Dialysis	55 (55%)

Participants averaged 56.3 years old, with a standard deviation of 11.4 years. There were 62% more male patients than female (38%). From 1–12 years, patients had CRF for 5.4 years on average. Dialysis was a possibility for 45 of 100 patients but not 55.

#### Thyroid Hormone Levels

**Table 2: Thyroid Hormone Levels among Study Participants**

Hormone	Mean ± SD	Range
<b>TSH</b>	6.3 ± 3.2 $\mu$ IU/mL	2.1 - 15.4 $\mu$ IU/mL
<b>T3</b>	1.1 ± 0.4 ng/mL	0.5 - 2.2 ng/mL
<b>T4</b>	7.5 ± 2.5 $\mu$ g/dL	3.2 - 14.0 $\mu$ g/dL

An increased mean TSH level of 6.3  $\mu\text{IU/mL}$ , above the normal range of 0.4-4.0  $\mu\text{IU/mL}$ , indicating hypothyroidism. The average T3 level was 1.1  $\text{ng/mL}$ , whereas the average T4 level was 7.5  $\mu\text{g/dL}$  on the lower end of the normal range of 4.5-12.0  $\mu\text{g/dL}$ .

### Prevalence of Thyroid Dysfunction

**Table 3: Prevalence of Thyroid Dysfunction in CRF Patients**

Thyroid Dysfunction	Number of Patients	Percentage (%)
Hypothyroidism	38	38%
Hyperthyroidism	12	12%
Euthyroidism	50	50%

The results showed that 38% of people had hypothyroidism (high TSH and low T3 and T4). When TSH was low and T3 or T4 were high, 12% of individuals were diagnosed with hyperthyroidism. Half of the patients had euthyroidism normal thyroid hormone levels.

### Correlation Analysis:

Using correlation analysis, thyroid hormone levels were linked to many clinical factors, including CRF duration and dialysis status. Results are summarised in Table 4.

**Table 4: Correlations between Thyroid Hormone Levels and Clinical Factors**

Factor	TSH vs. Duration of CRF	T3 vs. Duration of CRF	T4 vs. Duration of CRF	TSH vs. Dialysis Status	T3 vs. Dialysis Status	T4 vs. Dialysis Status
Correlation Coefficient (r)	0.32**	-0.28*	-0.24*	0.22*	-0.30**	-0.26*
p-Value	0.01	0.03	0.05	0.05	0.02	0.04

\* $p < 0.05$ , \*\* $p < 0.01$

### Statistical Significance

The research indicated a considerable positive correlation between TSH levels and CRF duration ( $r = 0.32$ ,  $p = 0.01$ ). However, T3 levels decreased as CRF duration increased ( $r = -0.28$ ,  $p = 0.03$ ). T4 levels were associated with CRF duration ( $r = -0.24$ ,  $p = 0.05$ ), but only slightly. Due to a positive connection ( $r = 0.22$ ,  $p = 0.05$ ), dialysis patients have higher TSH levels.

A statistically significant negative correlation ( $r = -0.30$ ,  $p = 0.02$ ) shows that dialysis patients had lower T3 levels. Dialysis patients have lower T4 levels ( $r = -0.26$ ,  $p = 0.04$ ). The study indicated that CRF patients at JLNMC Bhagalpur have greater hypothyroidism than hyperthyroidism, indicating thyroid dysfunction. TSH was higher than usual, but T3 and T4 were lower. Dialysis status was associated with high TSH and decreased T3 and T4 levels, while prolonged CRF duration was associated with elevated T3 and lower T4. Thyroid hormone levels in CRF patients must be monitored since CRF and its treatments impair thyroid function.

### Discussion

JLNMC Bhagalpur CRF patients have high rates of thyroid impairment. In specifically, 12% had hyperthyroidism and 38% hypothyroidism. These findings support prior findings that CRF patients have thyroid dysfunction due to the complex relationship between renal impairment and thyroid hormone metabolism. In our study, the average TSH level was high (6.3  $\mu\text{IU/mL}$ ), whereas T3 and T4 levels were below the normal range. This pattern—high TSH and low T3 and T4—is consistent with "uremic hypothyroidism," a renal disease-related reduction in thyroid hormone production and utilisation. The significant correlation between TSH levels and CRF duration suggests that prolonged CRF may aggravate thyroid dysfunction. Longer CRF may exacerbate thyroid hormone imbalance due to reduced peripheral T4 to T3 conversion or changed thyroid hormone binding, according to negative associations between T3 and T4 levels and CRF duration.

**Table 5: Comparison Table**

Study	Study Type	Sample Size	Key Findings
Present Study	Retrospective Study	100	Prevalence of hypothyroidism (38%) and hyperthyroidism (12%). Elevated TSH levels with low T3 and T4. Significant correlations between TSH levels and duration of CRF, and between T3 levels and dialysis status.
Study 1	Cross-Sectional	150	High prevalence of hypothyroidism in CRF patients. Elevated

[13]	Study		TSH and low T3 levels observed. Found that thyroid dysfunction is a common complication in CRF.
<b>Study 2</b> [14]	Cross-Sectional Study	120	Significant impact of CRF on thyroid hormone metabolism. Elevated TSH and decreased T3 and T4 levels in CRF patients. Emphasized the role of uremic toxins in thyroid dysfunction.
<b>Study 3</b> [15]	Observational Study	200	Observed high prevalence of hypothyroidism in CRF patients. Elevated TSH levels with low T3 and T4. Focused on the relationship between dialysis and thyroid hormone levels.

Our study confirms previous findings that CRF patients had thyroid impairment. For instance, study 1 reported that CRF patients often have hypothyroidism and abnormal thyroid hormone levels. Study 2 found that CRF disrupts thyroid hormone metabolism, causing hypothyroidism. Furthering these findings, our research examines thyroid dysfunction and the relationship between thyroid hormones and clinical factors such as CRF duration and dialysis status. However, our analysis contradicts several earlier findings. In contrast to Study 3, our data found a higher prevalence of hyperthyroidism (12%) than hypothyroidism. This gap may be due to patient demographics, location, or sample size. TSH levels were positively correlated with CRF severity, whereas T3 and T4 levels were not.

### Limitations

Some disclaimers about this research are important. The retrospective study uses pre-existing medical data, which may bias data completeness and accuracy. Over time, testing procedures or record quality may affect outcomes. Second, because CRF aetiologies and therapy vary, the 100-patient sample may not accurately represent the CRF community. The study only included patients from one hospital; therefore the results may not apply to other populations or circumstances.

### Future Research

Future prospective research with a larger and more diverse population should address these limitations. This includes investigating thyroid hormone binding proteins and uremic toxins. Studying thyroid hormone replacement therapy and other thyroid insufficiency treatments may improve CRF patient outcomes. Overall, JLNCH Bhagalpur CRF patients have a significant proportion of thyroid dysfunction, with a large fraction displaying hypothyroidism and hyperthyroidism. Our findings support earlier research that CRF alters thyroid hormone levels. The study emphasises the importance of routine thyroid function monitoring for CRF patients and early therapy of hypothyroidism and hyperthyroidism to avoid health issues. The retrospective technique and limited sample size are drawbacks, but it provides the framework for future studies to help us understand CRF thyroid dysfunction and how to treat it.

### Conclusion

A study of people with chronic renal failure (CRF) at JLNCH Bhagalpur discovered problems with their thyroids. Having high TSH and low T3 and T4 makes this group more likely to be hypothyroid or hyperthyroid. The study found that people with CRF often have problems with their thyroids. Thyroid function needs to be carefully watched and controlled. TSH levels affect the length of the CRF, and T3 levels affect the need for dialysis. These results back up what other research has found: thyroid function tests should be part of CRF treatment to get better results.

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