Assessment of the Thyroid Hormones in Patient with Chronic Renal Failure Undergoing Maintenance Haemodialysis in Hospital Cross Section Study

Amira M. El Sayed, Ayman M. Elbadawy, Mohamed S. Saleh, Ghada Z. Rady* and Walaa M. Ibrahim
Internal Medicine Department, Faculty of Medicine, Banha University, Banha, Egypt
***Corresponding Author:** Ghada Z. Rady, Email: ghadazaki626@gmail.com, Phone: +201009798017

ABSTRACT

Background: A significant alteration in thyroid hormone function tests occurred in chronic kidney disease (CKD) patients especially if they are on dialysis.

Objective: The purpose of our study was to determine the prevalence of thyroid hormone abnormalities among chronic renal failure patients undergoing maintenance haemodialysis, and to assess the connection between thyroid hormones dysfunction, duration of dialysis, complication of chronic renal failure and other comorbidities.

Patients and Methods: This cross-section study was executed on 200 patients exceeding the age of 18, with confirmed end-stage renal disease (ESRD. Patients were split into 4 groups based on status of thyroid dysfunction into hypothyroidism group, hyperthyroidism group, normal thyroid or sick euthyroid group.

Results: There was overt hypothyroidism in 20 (64.51%) patients and subclinical hypothyroidism in 11(5.5 %) patients. However, overt hyperthyroidism was in 9 (4.5%) patients and subclinical hyperthyroidism was in 10 (5 %) patients. Sick euthyroid was found in 83 (41.50%) patients and finally, euthyroid patients was in 67 (33.50%) patients.

Conclusions: Thyroid hormone dysfunction is common in chronic renal failure patients undergoing maintenance hemodialysis, even in those who are clinically euthyroid.

Keywords: Thyroid dysfunction, Chronic Renal Failure, Hemodialysis.

INTRODUCTION

Chronic kidney disease (CKD) symbolizes problems and in public health and kidney disease outcome quality initiative (NKF/DOQI) defines it as renal injury that persists for a duration beyond three months, accompanied by structural or functional problems, and may or may not involve a reduction in GFR characterized by indications of kidney injury or pathological abnormalities, or by a GFR of < 60 mL/min/1.73 m^2. In light of GFR value, CKD is separated into five stages [1]. Kidney Disease Improving Global Outcomes (KDIGO) guidelines define CKD through the utilization of kidney damage markers (proteinuria and glomerular filtration rate). Kidney disease (CKD) is characterized by the coexistence of two indicators: a GFR of less than 60 mL/min (1.73 m^2) and albumin levels over 30 mg/g of creatinine; additionally, the presence of structural or functional abnormalities in the kidneys for a duration beyond three months is required [2]. A GFR < 15 mL/min/min1.73m2 or CKD stage 5 indicates end-stage renal disease (ESRD). Continuous organ support can be administered using a diverse range of methodologies to aid renal function. Rigorous extracorporeal methods, paracorporeal or hemodialysis techniques, and peritoneal dialysis comprise renal replacement therapy (RRT) [3]. A range of endocrine diseases, including insulin resistance and secondary hyperparathyroidism, have been identified as extra-renal consequences of CKD and as possible indicators of morbidity and death in this demographic [4].

Diverse factors contribute to thyroid problems in patients with CKD. CKD patients have a greater prevalence of hypothyroidism than the overall population [5]. Through the action of isoform D1 of the enzyme T4-5′-deiodinase, the kidney contributes to the synthesis of serum free triiodothyronine (FT3) by deiodinating free thyroxine (FT4). Uremic toxins, metabolic acidosis, malnutrition, heparin (as used in hemodialysis), chronic inflammation, hepatitis C virus (HCV) infection, advanced age and specific drugs including amiodarone, steroids, and beta-blockers have also been linked to thyroid dysfunction in CKD [6].

Hyperthyroidism or hypothyroidism can impact the function of the renal tubules, the GFR, and induce proteinuria. Thyroid hormone function tests are significantly altered in CKD patients, particularly those who are on dialysis. Thyroid replacement therapy has the potential to preserve renal function in CKD patients [7,8].

The objective of this work was to evaluate the prevalence of thyroid hormone dysfunction in chronic renal failure patients undergoing maintenance hemodialysis, as well as the connection between thyroid hormones dysfunction, duration of dialysis, complication of chronic renal failure and other comorbidities.

PATIENTS AND METHODS

This cross-section research was conducted on 200 patients over the age of 18, with confirmed ESRD, with the following features: undergoing hemodialysis (three times a week, four hours/session), clinically stable patients, free of active infections and no previous history of thyroid disease. The study was performed in a period from February 2022 to January 2023.

Exclusion criteria; age of patients < 18 years, history of thyroid disease, thyroid and parathyroid surgeries, patients treated with interferon therapy, patients received or exposed to radiation and patients using antithyroid drugs or thyroid replacement therapy. Patients were categorized into four groups based on status of thyroid dysfunction into hypothyroidism group, hyperthyroidism group, normal thyroid or sick euthyroid group. Each patient underwent history taking, examining

Received:22/10/2023
Accepted:20/12/2023

the thyroid gland locally, laboratory investigations [complete blood count (CBC), HCV antibody, kidney function tests [serum creatinine and blood urea nitrogen (BUN) after the session of hemodialysis], thyroid function tests and serum level of Ca, PO_4, PTH (pg/mL)]. Assessment using life quality score and physical activity questionnaire to determine any alterations in life quality and physical activity in relation to chronic kidney disease or thyroid dysfunction.

Thyroid hormones assessment:
TSH (normal value: 0.39-3.55 μIU/ml), FT4 (normal value: 0.8-2 ng/dl), and FT3(normal value: 2.1-3.8 pg/ml) were determined utilizing Accu-Bind ELISA kit (Monobind Inc. Lake Forest, CA 92630, USA) [9].

Quality of life:
The health scores EQ-5D-5L were standardized into a single index value ranging from 0 to 1. The resulting quality of life was classified into three categories: good quality of life (0.67-1), fair quality of life (0.34-0.66), and poor quality of life (<0.33). [10].

Physical activity was classified as the following:
Adherence to physical activity as assessed by Global Physical Activity Questionnaire (GPAQ). Physically Active people were identified as those who exercise for ≥30 min/day. Moderate physical activity was defined as people who exercise for 15–30 min/day, while mild for those who exercise for <15 min a day, and sedentary to those who never engage in physical activity. [11].

Statistical analysis

V27 of SPSS was utilized for statistical analysis (IBM©, Chicago, IL, USA). Histograms and Shapiro-Wilk test were utilized to determine the normality of data distribution. Mean and standard deviation (SD) were employed to display quantitative parametric data, which were compared across the four groups employing ANOVA (F) test. Frequency and percentage (%) of qualitative variables were employed in Chi-square test for analysis. Statistical significance was determined utilizing a two-tailed P value of 0.05 or less.

Ethical considerations:
Following approval from Benha University Research Ethics Committee (approval code: MS 36-7- 2022), the study was executed. All patients provided written informed consents prior to their enrolment. The consent form explicitly outlined their agreement to participate in the study and for the publication of data, ensuring protection of their confidentiality and privacy. Regarding research involving human subjects, this investigation was conducted in adherence to The Code of Ethics of the World Medical Association (Declaration of Helsinki).

RESULTS

Table 1 reveals the demographic data, clinical and laboratory investigation of the studied patients.100 (50%) patients were females, and 100 (50%) patients were males. Mean age was 47.5 ±13.99 years. Quality of life score was fair in 146 (73%). Global Physical activity was moderate in 131 (65.5%) patients. The most common etiology of CKD was polycystic kidney and systemic lupus erythematosus. The most common complication was anemia in 41(20.5%) patients. The mean value of TSH was 2.8± 1.66 mIU/L, while free T3 and free T4 were 2.4 ± 0.82 pg/ml and 1.5 ± 0.66 ng/dL respectively.

Table 1: Demographic data, clinical and laboratory investigation of the studied patients

		N = 200
Age		47.5 ± 13.99
Sex	**Male**	100 (50%)
	Female	100 (50%)
Marital status	**Married**	156 (78%)
	Single	44 (22%)
Residence	**Urban**	78 (39%)
	Rural	122 (61%)
Occupation	**Worker**	109 (54.5%)
	No	91 (45.5%)
Quality of life (EQ-5D-5L score)	**Good**	19 (9.5%)
	Fair	146 (73%)
	Poor	35 (17.5%)
Global Physical activity	**Near perfect**	31 (15.5%)
	Moderate	131 (65.5%)
	Sedentary	38 (19%)
Etiology of CKD		
HTN		20 (10%)
Diabetes		15 (7.5%)
HTN and DM		19 (9.5%)
Polycystic kidney		29 (14.5%)
Systemic lupus erythematosus		27 (13.5%)
Analgesic nephropathy		24 (12%)
Primary glomerulonephritis		23 (11.5%)
Laboratory investigations		
Urea (mg/dL)		89.6 ± 21.47
Serum creatinine (mg/dL)		4.1 ± 0.71
Ca level (mg/dL)		8.6 ± 0.94
PO_4 level (mg/dL)		4.3 ± 1.01
PTH (pg/mL)		342.7 ± 149.37
HCV infection		97 (48.5%)
Thyroid function test		
TSH (mIU/L)		2.8 ± 1.66
Free T3 (Pg/ml)		2.5 ± 0.74
Free T4 (ng/dL)		1.5 ± 0.66
Complications		
Ca and PO_4 imbalance		37 (18.5%)
Acidosis		2 (1%)
Anemia		41 (20.5%)
Hyperkalemia		6 (3%)
Volume overload		20 (10%)

Data are displayed as mean ± SD or frequency (%). HTN: hypertension, CKD: chronic kidney disease, DM: diabetes mellitus, PO4: phosphorus, PTH: parathyroid hormone, HCV: Hepatitis C virus, TSH: Thyroid stimulating hormone, Free T3: Triiodothyronine, Free T4: Thyroxine.

Table 2 reveals that in high TSH group, free T3 and T4 were high in 0 patients (TSH secreting adenoma or thyroid hormone resistance), low in 20 patients and normal in 11 patients. However, in low TSH group, free T3 and T4 were high in 9 patients, low in 0 patients (central hypothyroidism) and normal in 10 patients. In normal TSH group, free T3 was low and free T4 was normal in 83 patients and normal free T3 and free T4 in 67 patients (euthyroid patients).

Table 2: Category of thyroid dysfunction according to the level of TSH.

		N=200	
	Level of free T3 and free T4	**Free T3**	**Free T4**
High TSH(n=31)	**High**	0 (0%)	
	Low (Overt in hypothyroidism)	20 (10%)	
	Normal (Subclinical in hypothyroidism)	11(5.5%)	
Low TSH(n=19)	**High (Overt in hyperthyroidism)**	9 (4.5%)	
	Low	0 (0%)	
	Normal (Subclinical in hyperthyroidism)	10 (5%)	
Normal TSH (n=150)	**T3 low and T4 normal (Sick euthyroid)**	83 (41.50%)	
	Normal	67 (33.50%)	

Data are displayed as frequency (%), TSH: Thyroid stimulating hormone, Free T3: Triiodothyronine, Free T4: Thyroxine.

In hypothyroidism group, TSH was significantly greater in overt group than subclinical group. Free T3 and free T4 were significantly reduced in overt group than subclinical group. In hyperthyroidism group, TSH was insignificantly different between overt group and subclinical group. Free T3 and free T4 were significantly greater in overt group than subclinical group **(Table3)**.

Table 3: Thyroid hormones levels in patients with CKD and thyroid dysfunction

Hypothyroidism group (n=31)			
	Subclinical (n=11)	**Overt (n=20)**	**P value**
TSH (mIU/L)	4.8 ± 0.2	7.21 ± 1.71	**<0.001***
Free T3 (Pg/ml)	3.03 ± 0.41	2.11 ± 0.28	**<0.001***
Free T4 (ng/dL)	1.33 ± 0.31	0.98 ± 0.2	**0.005***
Hyperthyroidism group (n=19)			
	Subclinical	**Overt**	P
TSH (mIU/L)	0.15 ± 0.09	0.12 ± 0.01	0.965
Free T3 (Pg/ml)	2.95 ± 0.55	3.63 ± 0.57	**0.016***
Free T4 (ng/dL)	1.62 ± 0.32	3.87 ± 0.45	**<0.001***
Sick euthyroid group (n=83)			
	Subclinical	**Overt**	P
TSH (mIU/L)	2.6 ± 1.06	----	----
Free T3 (Pg/ml)	1.8 ± 0.27	----	----
Free T4 (ng/dL)	1.5 ± 0.33	----	----

Data are displayed as mean ± SD, *significant P, TSH: Thyroid stimulating hormone, Free T3:Triiodothyronine, Free T4: Thyroxine. Mann-Whitney test was used.

In terms of demographic characteristics and etiology of CKD, there was no significant impact on state of thyroid function **(Table 4)**.

Table 4: Relation between state of thyroid function and clinical characteristics of CKD

		Normal group (n=67)	Hypo-thyroidism group (n=31)	Hyper thyroidism group (n=19)	Sick euthyroid group (n=83)	P- value
Age (years)		48.8 ± 12.39	46.3 ± 14.97	47.4 ± 14.38	47 ± 14.9	0.772
Sex	**Male**	31 (46.27%)	19 (61.29%)	11 (57.89%)	39 (46.99%)	0.435
	Female	36 (53.73%)	12 (38.71%)	8 (42.11%)	44 (53.01%)	
Marital status	**Married**	54 (80.6%)	28 (90.32%)	16 (84.21%)	58 (69.88%)	0.085
	Single	13 (19.4%)	3 (9.68%)	3 (15.79%)	25 (30.12%)	
Residence	**Urban**	29 (43.28%)	16 (51.61%)	9 (47.37%)	24 (28.92%)	0.082
	Rural	38 (56.72%)	15 (48.39%)	10 (52.63%)	59 (71.08%)	
Occupation		33 (49.25%)	21 (67.74%)	9 (47.37%)	46 (55.42%)	0.340
Quality oflife	**Good**	6 (8.96%)	2 (6.45%)	1 (5.26%)	11 (13.25%)	0.719
	Fair	51 (76.12%)	22 (70.97%)	13 (68.42%)	59 (71.08%)	
	Poor	10 (14.93%)	7 (22.58%)	5 (26.32%)	13 (15.66%)	
Global physical activity	**Near perfect**	13 (19.4%)	4 (12.9%)	4 (21.05%)	11 (13.25%)	0.640
	Moderate	40 (59.7%)	23 (74.19%)	10 (52.63%)	58 (69.88%)	
	Sedentary	14 (20.9%)	4 (12.9%)	5 (26.32%)	14 (16.87%)	
Etiology of CKD						
HTN		7 (10.45%)	2 (6.45%)	3 (15.79%)	8 (9.64%)	0.115
Diabetes		7 (10.45%)	3 (9.68%)	1 (5.26%)	4 (4.82%)	
HTN and DM		3 (4.48%)	5 (16.13%)	0 (0%)	9 (10.84%)	
Poly cystic kidney		13 (19.4%)	5 (16.13%)	4 (21.05%)	7 (8.43%)	
Systemic lupus erythematosus		14 (20.9%)	4 (12.9%)	2 (10.53%)	7 (8.43%)	
Analgesic intake		9 (13.43%)	3 (9.68%)	3 (15.79%)	8 (9.64%)	
Primary glomerulonephritis		5 (7.46%)	2 (6.45%)	1 (5.26%)	15 (18.07%)	

Data are displayed as mean ± SD or frequency (%), CKD: Chronic kidney disease, DM: Diabetes mellitus, HTN: Hypertension. Kruskal-Wallis test was used for not normally distributed data.

Laboratory investigations; urea, serum creatinine, Ca level, PO_4 level, PTH and HCV infection were insignificantly different in relation to the state of thyroid in patients with CKD. Complications such as (Ca and phosphate imbalance, anemia, hyperkalemia and volume overload) were significantly different in relation to the state of thyroid in patients with CKD, while acidosis was insignificantly different **(Table 5)**.

Table 5: Laboratory investigations and complications of the studied groups

	Normal group (n=67)	Hypothyroidism group (n=31)	Hyperthyroidism group (n=19)	Sick euthyroid group (n=83)	P value
Urea (mg/dL)	92.9 ± 20.65	85 ± 19.59	92.9 ± 5.49	88 ± 21.69	0.102
Serum creatinine (mg/dL)	4 ± 0.72	4.3 ± 0.65	4.2 ± 0.78	4 ± 0.71	0.170
Ca level (mg/dL)	8.4 ± 0.9	8.7 ± 1.05	8.5 ± 0.88	8.6 ± 0.92	0.155
PO4 level (mg/dL)	4.4 ± 1.01	4.1 ± 1.03	4 ± 0.96	4.3 ± 1.03	0.081
PTH (pg/mL)	338.5 ±61.72	306.7 ± 47.52	325.3 ± 38.11	363.5±41.19	0.157
HCV infection	33 (49.25%)	21 (67.74%)	9 (47.37%)	46 (55.42%)	0.340
Complications					
Ca and phosphate imbalance	2 (2.99%)	7 (22.58%)	5 (26.32%)	23 (27.71%)	**<0.001***
P1		**<0.001***	**<0.001***	**<0.001***	
P2			0.507	**<0.001***	
P3				**0.002***	
Acidosis	2 (2.99%)	0 (0%)	0 (0%)	0 (0%)	0.214
Anemia	4 (5.97%)	16 (51.61%)	8 (42.11%)	13 (15.66%)	**< 0.001***
P1		**< 0.001***	**0.016***	**< 0.001***	
P2			0.570	0.376	
P3				**0.023***	
Hyperkalemia	0 (0%)	1 (3.23%)	3 (15.79%)	2 (2.41%)	**0.005***
P1		0.316	**0.009***	**0.009***	
P2			0.147	1.00	
P3				**0.043***	
Volume overload	1 (1.49%)	6 (19.35%)	2 (10.53%)	11 (13.25%)	**0.024***
P1		**0.003***	0.121	**0.012***	
P2			0.693	0.394	
P3			1.00		

Data are displayed as mean ± SD or frequency (%), *Significant P, P1: P value compared to Normal group, P2: P value compared to Hypothyroidism group, P3: P value compared to Hyperthyroidism group, PTH: Parathyroid hormone, HCV: hepatitis C virus. Kruskal-Wallis test was used for not normally distributed data.

DISCUSSION

CKD is a global public health concern. The NKF's K/DOQI defines CKD as renal disease that persists for a duration exceeding three months, accompanied by structural or functional abnormalities, a GFR of < 60 mL/min/1.73 m^2, and pathological abnormalities or indicators of kidney damage, with or without decreased GFR [12,13]. In our study, our patients had a prevalence of 31 (15.5 %) cases of hypothyroidism, of which 11 (5.5 %) were subclinical and 20 (10 %) were overt. In contrast, 33.5% of our patients exhibited euthyroidism. **Hassan-Kadle *et al.*** discovered that the prevalence rates for main and subclinical hypothyroidism were 12.5% and 7.6% [14]. As opposed to our outcome, **Alshammari *et al.*** observed that the incidence of hypothyroidism and a decline in GFR were not significantly connected [6], whereas **Toda *et al.*** noticed a statistically significant connection [15]. This could potentially be accounted for by variations in the reference ranges utilized to diagnose the thyroid hormone state among patients with distinct characteristics. Our analysis reveals a greater prevalence of hypothyroidism in contrast to the prevalence of hypothyroidism reported elsewhere in a study by **Halahleh *et al.***, which was estimated as5.3% [16]. Contrary to the findings of our research, **Adani *et al.*** established that a 28 percent prevalence of hypothyroidism existed among their patients. A total of 42.2 percent exhibited overt hypothyroidism, while 57.8 percent had subclinical hypothyroidism [17].

Diverse investigations have indicated that these thyroid profile abnormalities may have been an energy-conservation adaptive strategy of the organism. A high rate of abnormal thyroid hormone profiles in patients with CKD, as this investigation has shown, may be attributable to iodine deficiency or excess iodine nutrition, the prevalence of thyroid autoimmunity in the study population, or the existence of subjects with non-thyroidal illnesses [18].

Our study revealed variations in thyroid hormone levels among the patients, with a significant proportion showing abnormal levels of free T3 and free T4 in relation to TSH levels. While the hyperthyroidism group showed suppressed TSH levels and increased free T3 and free T4 levels. Supporting our results, **Cotoi *etal.*** identified a significant proportion of patients (46.34 %)

with low T3 levels. Low T3 syndrome, often known as "euthyroid sick syndrome," is a persistent non-thyroidal sickness resulting from protein deficiency and uremia. Following this, serum concentrations of FT3 and/or FT4 are susceptible to fluctuations caused by conditions unrelated to the thyroid that may not precisely reflect the functional status of the thyroid. The majority of patients were euthyroid (72.4%) [19], Nevertheless, these patients frequently develop hypothyroidism (24.4 %). **Schiller *et al.*** demonstrated that around 20% of uremic patients may exhibit a decrease in FT3 concentrations. This decrease is correlated with malnutrition, intercurrent processes, duration of dialysis, and inflammatory markers [20]. Similarly, **Abughalia *et al.*** documented that during hemodialysis, healthy serum levels of T3 were present in 29 (63 %) of 46 chronic renal failure patients, whereas normal serum levels of T4 were found in 41 (89 %) of 46 patients. In addition, their results showed that the mean value of T3 before and after hemodialysis were 110 ± 32 ng/dl and 121 ± 37 ng/dl, respectively. The mean values of serum level of T4 were 4.5 µg/dl before hemodialysis and 5.9 µg/dl after hemodialysis. Serum concentrations of T3 and T4 changed significantly between the pre- and post-hemodialysis periods. Hemodialysis treatment raises serum concentrations of both T3 and T4 hormones, according to these findings [21].

In the present study, the duration of hemodialysis was 4 ± 1.88 years. The duration of hemodialysis had no significant correlation with the state of thyroid function. Consistent with our findings, **Cotoi *et al.;*** no association between TSH concentration and dialysis duration was found to be statistically significant. (r = 0.006, r = 0.944 respectively) [19]. In disagreement with our results, **Bichari *et al.*** demonstrated that in regard to the connections between thyroid hormones and a variety of laboratory and clinical data, only a significantly direct relationship existed between TSH levels and hemodialysis duration [9].

In the current study, Ca and phosphate imbalance were significantly higher in hypothyroidism group, hyperthyroidism group and sick euthyroid group than normal group. Ca and phosphate imbalance were insignificantly different between hypothyroidism group and hyperthyroidism group. In the same line with our results, **Begic-Karup *et al.*** suggested a potential association between hyperthyroidism and elevated serum calcium levels in some individuals, highlighting the intricate relationship between thyroid function and calcium metabolism. Serum Ca levels were assessed in various thyroid- related conditions and compared to healthy individuals [22].

In our study, HTN was a common etiological factor across all groups, with prevalence ranging from 6.45% to 15.79%. Diabetes was also present in all groups but with relatively lower frequencies, ranging from 4.82% to 10.45%. Polycystic kidney disease, systemic lupus erythematosus, analgesic intake, and glomerulonephritis display different prevalence patterns across the groups. However, the etiology of CKD was insignificantly different among the four groups. This is in alignment with **Bichari *et al.*** [9], who reported that, etiology of renal failure did not exhibit any significant relationships with TSH; however, patients presenting with abnormal TSH demonstrated a considerably greater frequency of abnormal T4 levels, but not T3 levels.

In our study, HCV infection was insignificantly different among the four groups. This is in harmony with **Bichari *et al.***, who stated that there were no statistically significant connections observed between HCV infection and thyroid hormone levels [9]. In addition to **Ibrahim *et al.*** who had similar results [23]. In this study, anemia was significantly more prevalent in hypothyroidism and sick euthyroid groups compared to normal and hyperthyroidism groups. The prevalence of hyperkalemia was significantly greater in hyperthyroidism group in comparison to other groups. However, number of patients with volume overload was significantly greater in sick euthyroid groups as opposed to the other groups. Volume overload in hypothyroidism and sick euthyroid syndrome may be attributed to several factors, including impaired cardiac function, decreased renal blood flow, and altered fluid regulation [24].

In our results, acidosis did not show significant differences among the four groups. **Drechsler *et al.*** found that dialysis patients with sick euthyroid syndrome had a greater risk of cardiovascular events, anemia, and death than dialysis patients with normal thyroid function [25].

Limitations of our research were small sample size, which could affect the generalizability of the findings to larger populations, study design was cross-sectional, which hampers the capacity to build causal connections between chronic renal failure and thyroid dysfunction, and the study did not explore other potential factors that could influence thyroid hormone dysfunction, such as dietary factors, medication use, or other comorbidities.

CONCLUSIONS

Thyroid hormone dysfunction is common in chronic renal failure patients undergoing maintenance hemodialysis, even in those who are clinically euthyroid. The most common thyroid dysfunction is hypothyroidism, but hyperthyroidism and sick euthyroidism are also seen. The factors that assist in thyroid hormone dysfunction in these patients are not fully understood, but they may include the uremic milieu, inflammation, and medications. To fully comprehend the prevalence, contributing variables, and therapeutic ramifications of thyroid hormone deficiency in patients suffering from chronic kidney failure, more research is required.

Financial support and sponsorship: Nil
Conflict of Interest: Nil.

REFERENCES

1. **Ku E, Del Vecchio L, Eckardt K *et al.* (2023)**: Novel anemia therapies in chronic kidney disease: conclusions from a Kidney Disease: Improving Global Outcomes (KDIGO) Controversies Conference. Kidney Int., 104:655-80.
2. **Chen T, Knicely D, Grams M (2019)**: Chronic kidney disease diagnosis and management: A Review. JAMA., 322:1294-304.
3. **Bover J, Arana C, Ureña P *et al.* (2021)**: Hyporesponsiveness or resistance to the action of parathyroid hormone in chronic kidney disease. Nefrologia, 41:514-28.
4. **Liao M, Sung C, Hung K *et al.* (2012)**: Insulin resistance in patients with chronic kidney disease. J Biomed Biotechnol., 2012:691369.
5. **Raj R, Kumar V, Bhushan D *et al.* (2023)**: The prevalence of thyroid abnormalities in patients with chronic kidney disease: A cross-sectional study at a tertiary care hospital. Cureus, 15:e43065.
6. **Alshammari F, Alhazaa S, Althemery A *et al.* (2019)**: Prevalence of hypothyroidism among chronic kidney disease patients in security force hospital (SFH) in Saudi Arabia. J Family Med Prim Care,8:3313-7.
7. **Mohamedali M, Maddika S, Vyas A *et al.* (2014)**: Thyroid disorders and chronic kidney disease. Int J Nephrol., 2014:520281.
8. **Huang C, Li B, Reynolds K *et al.* (2020)**: Association between hypothyroidism and chronic kidney disease observed among an adult population 55 years and older. Medicine (Baltimore), 99:e19569.
9. **Bichari W, Khedr E, Sayed H *et al.* (2020)**: Prevalence of thyroid function abnormalities in patients with chronic renal failure under regular hemodialysis. The Egyptian Journal of Hospital Medicine, 80:594-8.
10. **Feng Y, Jiang R, Pickard A *et al.* (2022)**: Combining EQ-5D-5L items into a level summary score: demonstrating feasibility using non-parametric item response theory using an international dataset. Qual Life Res., 31:11-23.
11. **Cleland C, Hunter R, Kee F *et al.* (2014)**: Validity of the global physical activity questionnaire (GPAQ) in assessing levels and change in moderate-vigorous physical activity and sedentary behaviour. BMC Public Health, 14:1255.
12. **Goyal E, Puria A, Chaudhary S *et al.* (2023)**: Impact of psychiatric comorbidity on quality of life and activities of daily living among patients suffering from chronic kidney disease undergoing hemodialysis. Ind Psychiatry J., 32:S151-s6.
13. **Badro A (2023)**: Chronic Kidney Disease Management in Developing Countries. In: Al-Worafi YM, editor. Handbook of Medical and Health Sciences in Developing Countries : Education, Practice, and Research. 3. Cham: Springer International Publishing.
14. **Hassan-Kadle MA, Adani A, Eker H *et al.* (2021)**: Spectrum and prevalence of thyroid diseases at a tertiary referral hospital in Mogadishu, Somalia: A retrospective study of 976 Cases. Int J Endocrinol., 2021:7154250.
15. **Toda A, Hara S, Kato M *et al.* (2019)**: Association of thyrotropin concentration with chronic kidney disease in a Japanese general population cohort. Nephron., 142:91-7.
16. **Halahleh A (2017)**: General assessment of thyroid stimulating hormone (TSH) levels among people living in south of Hebron, Palestine. https://www.researchgate.net/publication/32225…
17. **Adani A, Siyad M, Adan A *et al.* (2023)**: Prevalence and determinants of hypothyroidism in patients on routine hemodialysis in Somalia: A Cross-Sectional Study. Int J Gen Med., 16:905-13.
18. **Isakova T, Nickolas T, Denburg M *et al.* (2017)**: KDOQI US Commentary on the 2017 KDIGO Clinical Practice Guideline Update for the Diagnosis, Evaluation, Prevention, and Treatment of Chronic Kidney Disease-Mineral and Bone Disorder (CKD-MBD). Am J Kidney Dis., 70:737-51.
19. **Cotoi L, Borcan F, Sporea I *et al.* (2020)**: Thyroid pathology in end-stage renal disease patients on hemodialysis. Diagnostics (Basel), 10: 245.
20. **Schiller A, Timar R, Siriopol D *et al.* (2015)**: Hepatitis B and C virus infection in the hemodialysis population from three romanian regions. Nephron., 129:202-8.
21. **Abughalia M, Alrzini A, Edawib R (2021)**: Evaluation of thyroid hormones levels in libyan patients with chronic renal failure before and after maintenance hemodialy. Open Journal of Applied Sciences, 11:11.
22. **Begic-Karup S, Wagner B, Raber W *et al.* (2001)**: Serum calcium in thyroid disease. Wien Klin Wochenschr., 113:65-8.
23. **Ibrahim M, Elwasly D, Emmam A *et al.* (2017)**: SP662 study of relation of hepatitis c seropositivity tand thyroid diseases in prevalent hemodialysis patients. Nephrology Dialysis Transplantation, 32:360-1.
24. **Jankauskas S, Morelli M, Gambardella J *et al.* (2021)**: Thyroid hormones regulate both cardiovascular and renal mechanisms underlying hypertension. J Clin Hypertens (Greenwich), 23:373-81.
25. **Drechsler C, Schneider A, Gutjahr-Lengsfeld L *et al.* (2014)**: Thyroid function, cardiovascular events, and mortality in diabetic hemodialysis patients. Am J Kidney Dis., 63:988-96.