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Correlation Between Calcium C+ and Vitamin D and Thyroid Hormones PTH in Patients with Kidney Failure

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Abstract

Chronic kidney disease (CKD) is a common health issue affecting 8% to 16% of the global population. This condition often co-occurs with other health complications, such as thyroid dysfunction, Calcium C+, and Vitamin D. Aim to: find out if there is a relationship Between Calcium C+ and Vitamin D and Thyroid Hormones PTH in Patients with Kidney Failure. Material and Methods: Data were collected using interviewer-administered questionnaires. Data from the biochemical analysis and questionnaire with a Google form survey were recorded in Microsoft Excel. Results: The lowest percentage was between 10 and 15 years 4(3.8%), the low percentage of C+ Vit D, for C+ 61(57.5%), for Vit D 68(64.2%), and parathyroid hormone (PTH) in hemodialysis patients was high 61(57.5%), the correlation between Gender, Age, Ca+, Vit D, and PTH parameters in hemodialysis patients the relationship between kidney failure and the percentage of Ca+, Vit D, and PTH p-value < 0.05, and the relationship between kidney failure and Gender, Age p-value > 0.05. Conclusion: there is a relationship between kidney failure and the percentage of Ca+, Vit D, and PTH, and there is no relationship between kidney failure and Gender and age.

Keywords: *Caldera Geopark, Development, Lake Toba Area, Tourism Sector.*

INTRODUCTION

The kidneys are a vital organ that filters blood and removes waste from the body (Al-jumaili & Al-Jumaili, 2024), Chronic kidney disease is a progressive disease with no cure and high morbidity and mortality (Alfakheri & Altamtam, 2023), Chronic hypoparathyroidism (HPT) is a rare disease characterized by low circulating calcium concentrations due to inappropriate parathyroid hormone (PTH) secretion (Gronemeyer et al. 2023). SHPT is the most common complication of chronic kidney disease (CKD) (Ren et al. 2024). Hyperparathyroidism is a clinical and laboratory syndrome characterized by hyperproduction of parathyroid hormone by the cells of the parathyroid glands (Aramovna et al. 2024).

The presence of hyperparathyroidism in early renal failure was first suggested by the data of Friis, Hahnemann, and Weeke (Arnaud 1973). The thyroid hormone influences the kidney by inducing systemic or local hemodynamic alterations and directly impacting its function (Charak et al. 2024), identifying modifiable factors associated with the onset of chronic kidney disease (CKD) is paramount (Demir et al. 2024), the impact of thyroid-stimulating hormone (TSH) on the new onset of CKD and its gender dependence remain undetermined (Endo et al. 2024), hyperparathyroidism (SHPT) is an integral component of CKD–mineral bone disorder and, if left unchecked, leads to a worsening of laboratory abnormalities, bone disease, and soft-tissue calcification (Evenepoel, Bover, and Ureña Torres 2016). The PTH-calcium curve provides a reliable assessment of parathyroid function, and as such, has considerable application for the study of parathyroid disorders in the clinical setting.(Felsenfeld and Llach 1993). The potential implications of high normal TSH on CKD progression could reshape clinical practice (Griffin and Griffin 2024).

Various hormonal and regulatory pathways have evolved that regulate the renal handling of calcium to maintain the serum calcium within defined limits despite dynamic changes in dietary calcium intake(Hanna et al. 2022). Controversy persists as to the optimal PTH target range in CKD, and how this target should change as CKD progresses, as well as how to best manage elevated PTH levels (Hawley and Holt 2017). Controversy persists as to the optimal PTH target range in CKD, and how this target should change as CKD progresses, as well as how to best manage elevated PTH levels (Iannone et al. 2024). It is not surprising, then, that ROD expression and shape are linked to hemodialysis survival rates (Khan et al. 2024). The exploration of CKD-MBD, which is associated with hyperphosphatemia, hypocalcemia, low serum levels of vitamin D, and increased PTH secretion, has gradually increased in recent years (Liu et al. 2023), low serum parathyroid hormone (PTH)

levels, hypocalcemia, and hyperphosphatemia. However, biochemical anomalies such as hypercalcemia due to over-supplementation and hypercalciuria may result, which could lead to kidney calcification and the formation of urinary stones (Luk et al. 2024).

Chronic PoHypoPT was defined by undetectable or inappropriately low plasma PTH concentration with hypocalcemia persistent for more than one year after total thyroidectomy (Mazoni et al. 2022), arising from vitamin D insufficiency (VDI) in chronic kidney disease (CKD) patients. Supplementation is widely used despite a lack of expert consensus regarding its effectiveness for lowering parathyroid hormone (PTH) levels (Strugnell et al. 2023), CKD (Chronic Kidney Disease) is a progressive condition that affects the kidneys' ability to filter blood and remove waste products from the body. Abnormalities in the thyroid gland can affect kidney function and contribute to the development of CKD (Ugege et al. 2023). While thyroid dysfunction is common in the broader US population (i.e., ~20 million US adults estimated to be affected), there has been growing recognition that there is a substantially higher prevalence of this endocrine derangement in chronic kidney disease (CKD) patients vs. their non-CKD counterparts (You et al. 2024). As awareness of uremic secondary hyperparathyroidism continues to increase, the Kidney Disease Improving Global Outcomes (KDIGO) organization has proposed surgical treatment for uremic patients with secondary hyperparathyroidism(Zhu et al. 2022), The parathyroid polypeptide hormone (PTH) is synthesized and cleaved into its active form in the parathyroid glands. PTH is vital for calcium homeostasis(Zuo et al. 2023). evaluating Cystatin C, Vitamin D, and Thyroid Function Test in patients with CKD (Anon, 2024).

Thyroid dysfunction can also result in notable alterations in kidney blood flow, glomerular filtration rate (GFR), tubular secretory and absorptive capacity, electrolyte pumps, and kidney structure. Both hypothyroidism and hyperthyroidism patients exhibit significant alterations in renal function (Anon, 2024), hyperparathyroidism (SHPT), a frequent complication of CKD, is characterized by the sustained elevation of parathyroid hormone (PTH) levels, which can inflict damage on multiple organ systems (Anon, 2024), the levels of PTH, ALT, AST, sodium and potassium, and a significant decrease (P=0.05) in the levels of Procalcitonin and calcium in all study groups compared to the control (Anon, 2024).

METHODS

Study design and setting: An institutional-based cross-sectional and interview, the study was conducted from February 1 to Jun 28, 2024, at the hemodialysis department in al-Wahda Hospital, Derna City, Libya. Study participants and size: All volunteer patients in the hemodialysis department aged between 10 and more than 71 years who were in the department during the hemodialysis period participated in this study. The study participants give them informed consent before the start of data collection. The study participants were selected based on a convenient sampling technique and 96 study participants were included.

Data collection and variables: Data were collected using interviewer-administered questionnaires. Data from the biochemical analysis and questionnaire with a Google form survey were recorded in Microsoft Excel, the questionnaires were prepared based on the previous related literature and Kidney Disease Improving Global Outcomes (KDIGO) guidelines. It was developed in the English language since the source populations of the study were fully communicated in English. The questionnaire includes socio-demographic variables (sex, age, resident place, source of drinking)

Data analysis: Data from the biochemical analysis was then cleaned and transferred into a statistical package for the social science (SPSS) version 26 software for the statistical analysis. The descriptive data analysis was conducted and presented as frequency and percentage. We also used a chi-square test to check the significance differences and P- value < 0.05 was used as a statistical significance.

RESULTS AND DISCUSSION

Figure 1. Percentage of Gender for hemodialysis patients

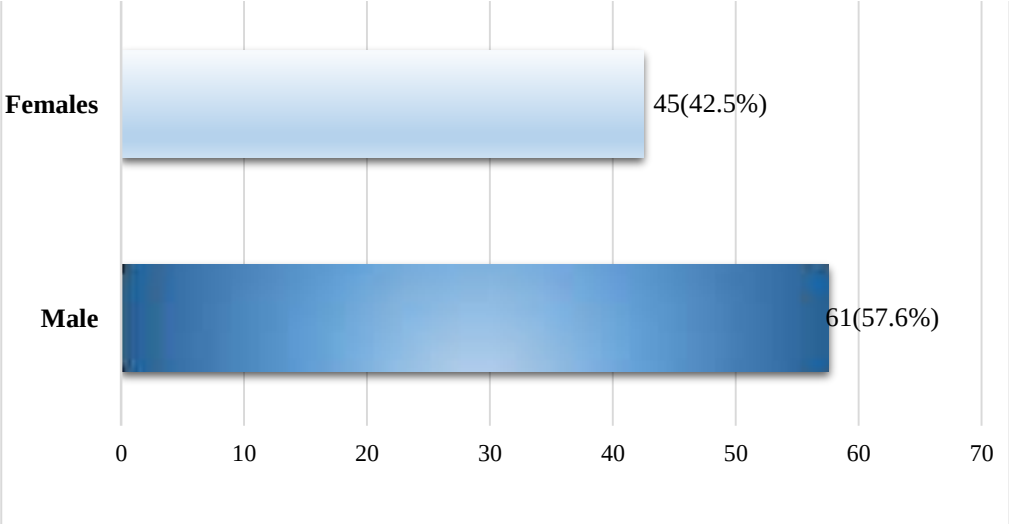


Figure 1. Illustrated percentage of Gender for hemodialysis patients That the males 61(57.6%) more than females 45(42.5%)

Figure 2. Percentage of age for hemodialysis patients

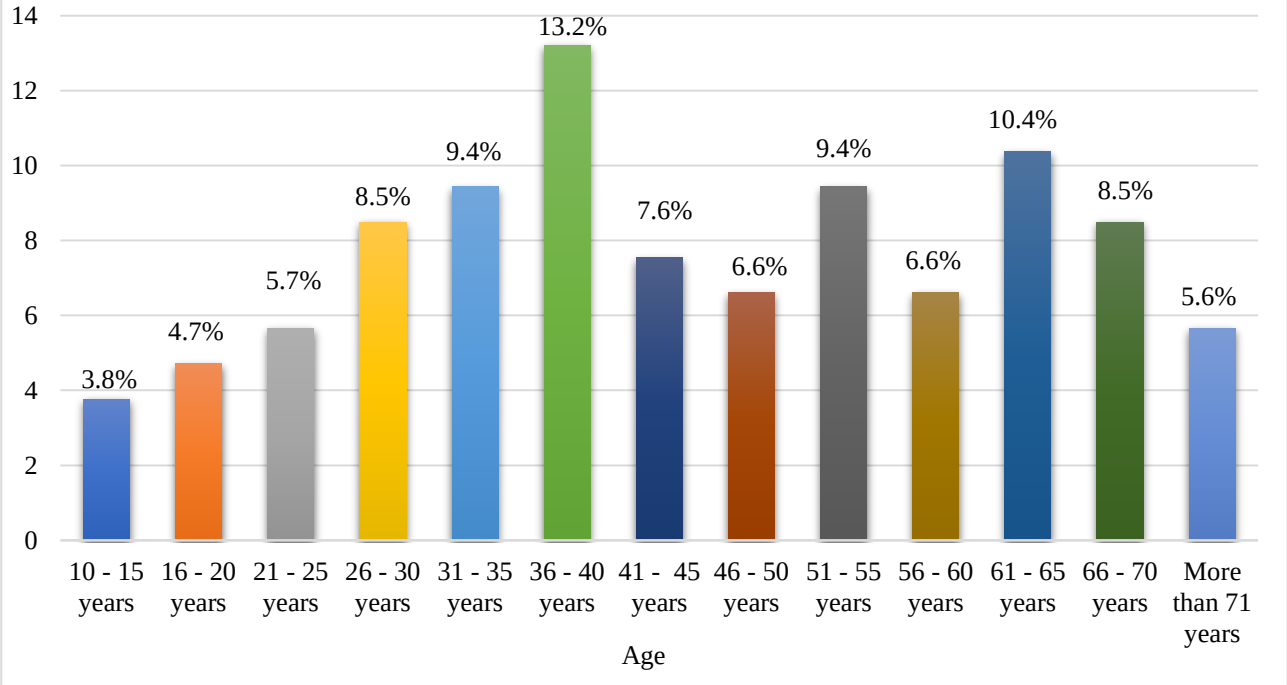


Figure 2 shows that the higher percentage and frequency of age groups were between 36 – 40 years old by 14 (13.2%) and The lowest percentage was between 10 and 15 years 4(3.8%)

Table 1. Percentage and frequency of Ca+, Vit D, PTH parameter

Analysis Results	Normal	Sever Law	Law	Moderate High	High
Ca+ Result	43(40.6%)	2(1.9%)	61(57.5%)	-	-
Vit D Result	27(25.5%)	7(6.6%)	68(64.2%)	4(3.8%)	
PTH Result	35(33.0%)	-	3(2.8%)	61(57.5%)	7(6.6%)

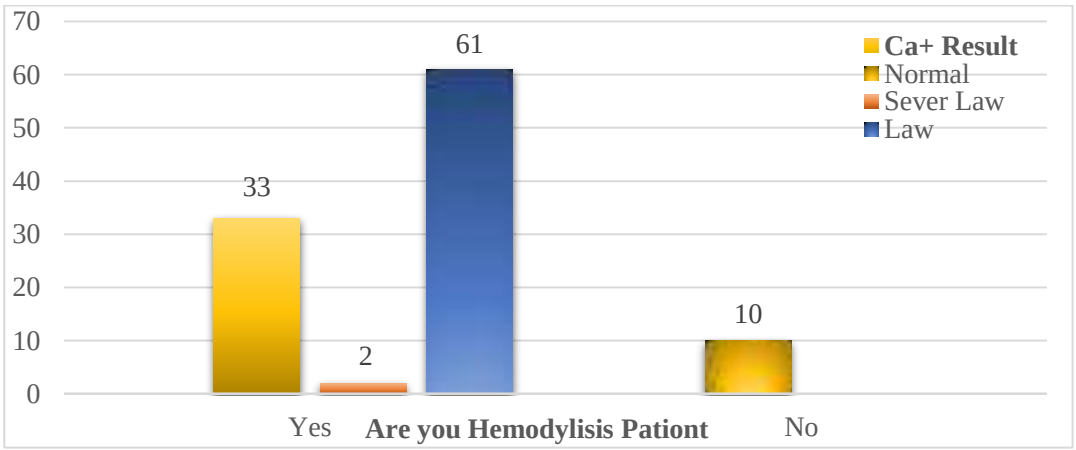
Table 1. Shows that the low percentage of C+ Vit D, for C+ 61(57.5%), for Vit D 68(64.2%), and parathyroid hormone (PTH) in hemodialysis patients was high 61(57.5%)

Table 2 the correlation between Gender, Age, Ca+, Vit D, and PTH parameters in hemodialysis patients

Analysis Results	P-Value	X^2
Gender	0.616	0.257a
Age	0.315	32.059a
Ca+ Result	0.000	16.177a
Vit D Result	0.000	32.307a
PTH Result	0.000	22.399a

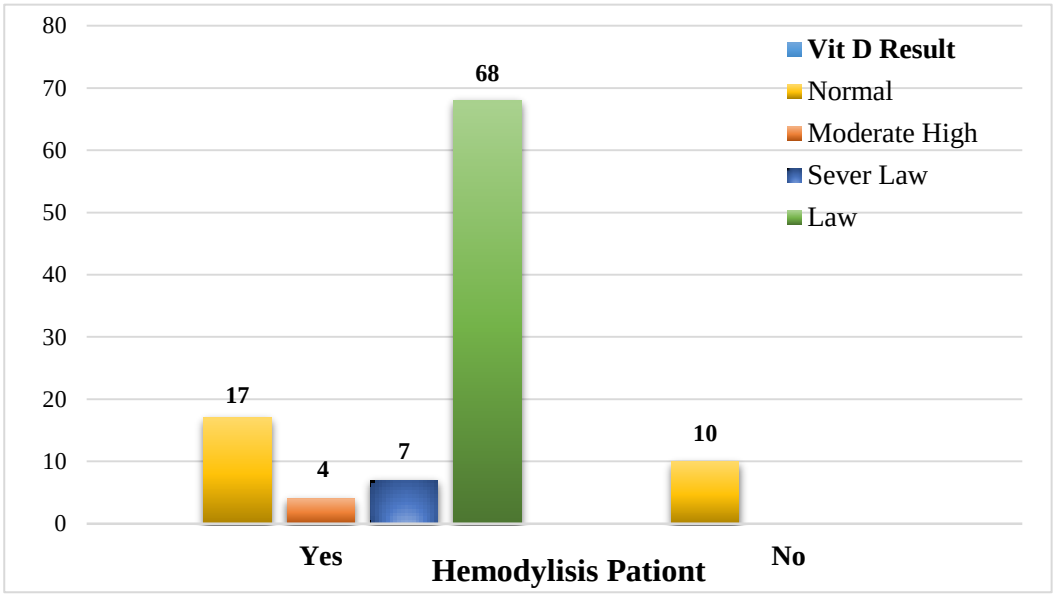
Table 2 the correlation between Gender, Age, Ca+, Vit D, and PTH parameters in hemodialysis patients the table shows the relationship between kidney failure and the percentage of Ca+, Vit D, and PTH Result because the p-value < 0.05, and there is no relationship between kidney failure and Gender, Age.

Figure 3. The correlation between Ca+, with hemodialysis patient



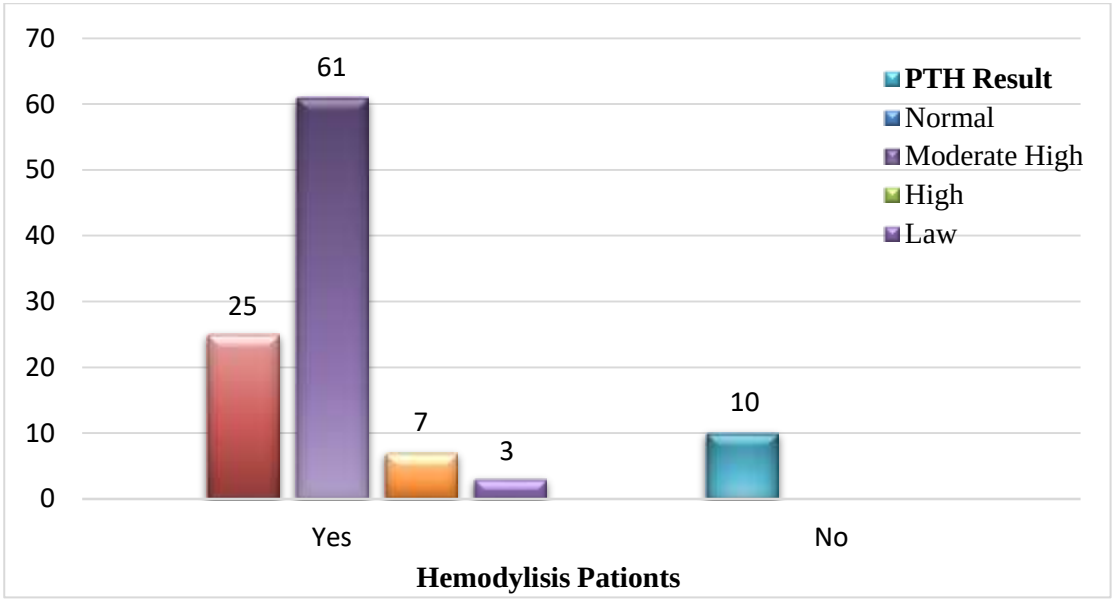
In Figure 3. Shows there are correlation between Ca+, with hemodialysis patients because the p-value < 0.05.

Figure 4. The correlation between Vit D, and hemodialysis patient



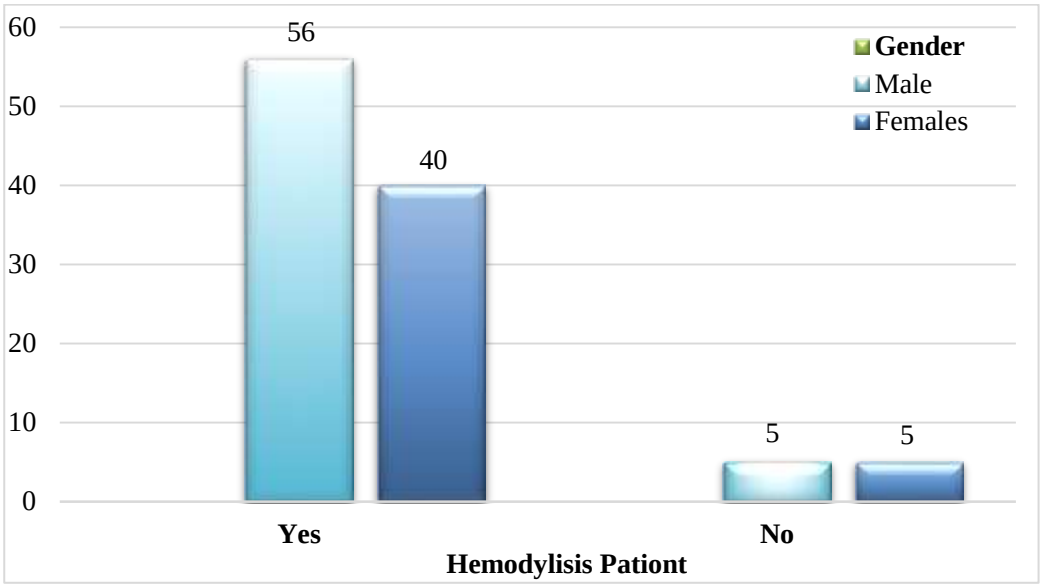
In Figure 4. Shows there a correlation between Vit D, with hemodialysis patients because the p-value < 0.05

Figure 5. The correlation between PTH parameters with hemodialysis patient



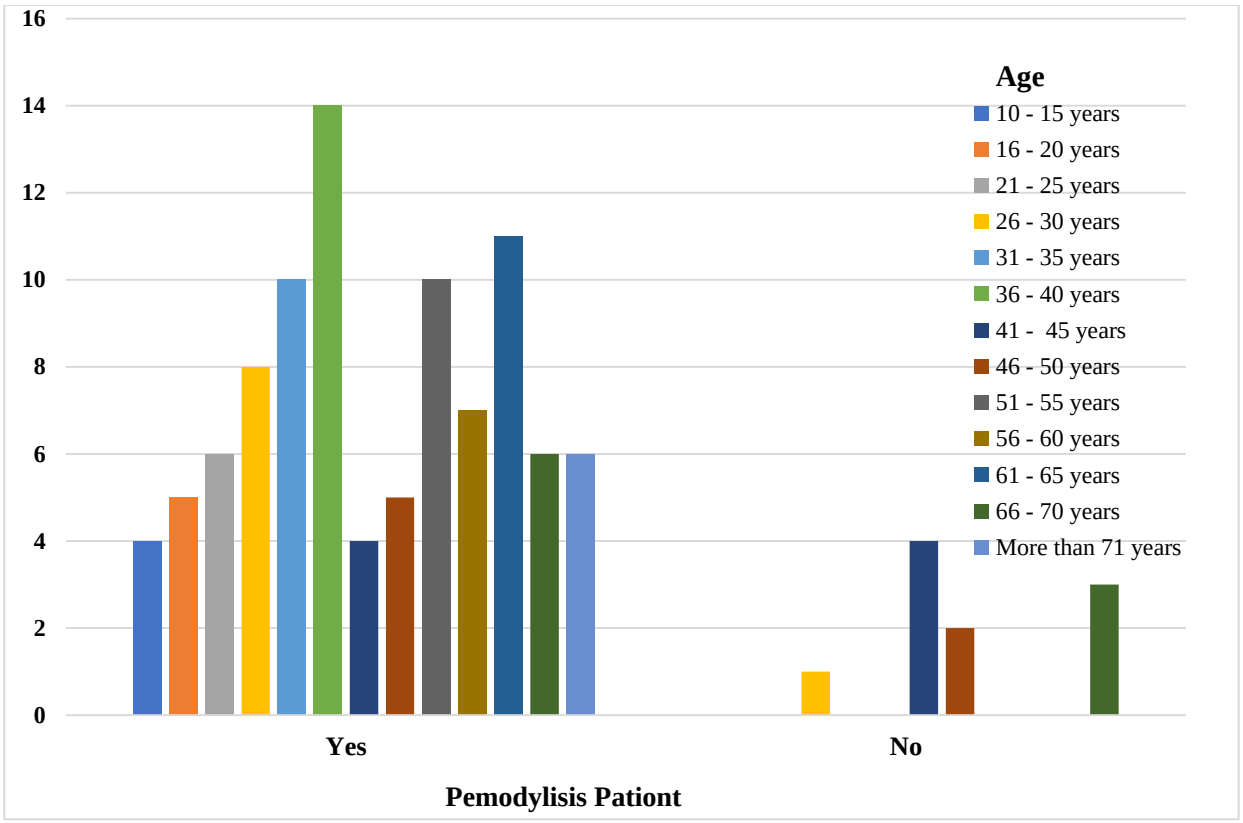
In Figure 5. Shows there are correlation between PTH, with hemodialysis patients because the p-value < 0.05

Figure 6. The correlation between Gender and hemodialysis patient



In Figure 6. Shows there is no correlation between gender, with hemodialysis patients because the p-value > 0.05

Figure 7. The correlation between age and hemodialysis patient



In Figure 7. Shows there is no correlation between gender, with hemodialysis patients because the p-value > 0.05.

The result of this study is noted in Figure 1. Illustrated percentage of Gender for hemodialysis patients That the males 61 (57.6%) more than females 45 (42.5%), Figure 2 shows that the higher percentage and frequency of age groups were between 36 – 40 years old by 14 (13.2%) and The lowest percentage was between 10 and 15 years 4 (3.8%), Table 1. Shows that the low percentage of C+ Vit D, for C+ 61

(57.5%), for Vit D 68 (64.2%), and parathyroid hormone (PTH) in hemodialysis patients was high 61(57.5%), Table 2 the correlation between Gender, Age, Ca+, Vit D, and PTH parameters in hemodialysis patients the table shows that the relationship between kidney failure and the percentage of Ca+, Vit D, and PTH Result because the p-value < 0.05, and there is no relationship between kidney failure and Gender, Age, In Figure 3 Shows there is correlation between Ca+, with hemodialysis patients because the p-value < 0.05, in Figure 4 Shows there is correlation between Vit D, with hemodialysis patients because the p-value < 0.05, In Figure 5 Shows there is correlation between PTH, with hemodialysis patients because the p-value < 0.05, In Figure 6 Shows there is no correlation between gender, with hemodialysis patients because the p-value > 0.05, In Figure 7 Shows there is no correlation between gender, with hemodialysis patients because the p-value > 0.05.

Our study agreed with the results of the study (Al-jumaili*1 and Al-Jumaili1 2024), which concluded that the level of PTH, vitamin D3, Ca, and PO4 was highly significant ($p \leq 0.0001$) increase in patients with Chronic Kidney Disease (CKD) in comparison with controls. There was a correlation between PTH levels and each (calcium, phosphor, and vitamin D3) in CKD patient groups.

This study showed that the increase in PTH levels leads to a decrease in total calcium levels and an increase in phosphor levels in patients with chronic kidney disease, and agreeing with (Alfakheri and Altamtam 2023), the PTH was higher in females than in males compared to the control group, and phosphate was higher in males than in females, while there was no significant difference in calcium levels.

Also agreed with (Charak et al. 2024), The clinician should recognize the association between thyroid problems and abnormal kidney function to consider performing a thyroid function test for patients with slightly raised biochemical indicators of renal function during treatment. Monitoring creatinine levels is necessary for people with thyroid disease. Also agreeing with (Demir et al. 2024) albuminuria may contribute to a reduction in free T3 levels in patients with CKD. However, physicians must recognize that CKD patients with elevated albuminuria levels may exhibit abnormal thyroid function. (Endo et al. 2024) conclusion, a high level of TSH is associated with an increased risk for the development of CKD in men but not in women. Also, agreeing with Parathyroid hormone metabolism and signaling in health and chronic kidney disease, they concluded that the relationship between circulating parathyroid hormone (PTH) concentration and outcomes in CKD patients is complex and rather weak, unless at the extremes (Evenepoel et al. 2016), agreeing within (Griffin and Griffin 2024), Thyroid Dysfunction and Chronic Kidney Disease, they concluded that The potential implications of high normal TSH on CKD progression could reshape clinical practice. Whereas the findings are significant, they also highlight the need for further research to validate these observations and explore their therapeutic implications. was highly effective in both raising serum 25OHD and decreasing iPTH in patients with SHPT, VDI, and stage 3 or 4 CKD.

iPTH-lowering response rates with ERC were similar to daily PLDC, the reference therapy; rates with IRC or HDC were significantly lower. ERC is an attractive alternative to vitamin D hormone therapy in CKD patients.(Strugnell et al. 2023), and agreeing with (You et al. 2024) in TSH levels in the high-normal ($\geq$3.0 mIU/L) and lower (<0.5 mIU/L) ranges were associated with incident CKD or CKD progression. Further studies are needed to determine whether correction of thyroid status ameliorates CKD risk.

CONCLUSION

This study was to find out if there was a relationship between dialysis patients, thyroid dysfunction, calcium C+, and vitamin D. The study showed that there is a close relationship between kidney failure and thyroid dysfunction, calcium C+ and vitamin D ratio, with no relationship between age or gender with kidney failure.

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