



Effects of Treatment Adherence on Clinical Outcomes at Hemodialysis Center

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ABSTRACT

Background: Chronic kidney disease (CKD) significantly affects patients' quality of life, especially those undergoing hemodialysis. Effective management requires strict adherence to treatment protocols, including medication intake, dietary and fluid restrictions, and regular session attendance. Non-adherence can negatively impact clinical indicators such as electrolytes, hemoglobin, creatinine, and blood urea levels, which are essential for monitoring patient stability.

Objectives: This study aimed to investigate the relationship between treatment adherence and clinical outcomes among patients receiving hemodialysis.

Methodology: A cross-sectional study was conducted among 122 hemodialysis patients at Raparin and Sulaymaniyah Dialysis Centers. Data were collected through structured interviews using a modified treatment adherence questionnaire. Clinical outcomes were obtained from patient records. Data analysis included descriptive and inferential statistics using SPSS version 27.

Results: The majority of the 122 patients were men, poorly educated, and jobless. Medication and session attendance were well adhered to, however; diet and hydration adherence were less so. Education level ($p = 0.015$) and comorbidity type ($p = 0.014$) had a significant impact on treatment adherence. Serum phosphate and adherence were significantly correlated ($p = 0.030$), but not with other clinical indicators.

Conclusion: Patients on hemodialysis generally adhered well to medication schedules and appointments but showed lower compliance with dietary and fluid guidelines. Improved adherence particularly in diet and fluid management through patient education and monitoring may enhance clinical stability and reduce complications.

Keywords: Renal Dialysis, Patient Compliance, Treatment Adherence, Clinical Outcomes, Chronic Kidney Disease.

INTRODUCTION

Chronic kidney disease (CKD) remains a global public health concern, affecting approximately 10% of the adult population worldwide and contributing to rising morbidity and healthcare costs (Lv et al., 2019; Bikbov et al., 2020). As CKD progresses to end-stage renal failure (ESRF), the kidneys lose their ability to excrete toxins, regulate fluids, and maintain electrolyte balance, requiring renal replacement

therapy for patient survival (Webster et al., 2017). Among available modalities, hemodialysis is the most widely used intervention, particularly in low- and middle-income countries due to limited access to transplantation services (Collins et al., 2021; Bello et al., 2019).

Patients undergoing hemodialysis must follow a lifelong, complex treatment regimen involving strict

adherence to medication, dietary restrictions, fluid intake limits, and scheduled dialysis sessions. Nonadherence in any of these areas has been associated with severe complications such as fluid overload, electrolyte imbalances, cardiovascular events, frequent hospitalizations, and increased mortality (Saran et al., 2003; Mellote et al., 2020). Conversely, patients who comply with treatment guidelines are more likely to maintain clinical stability and achieve better dialysis-related outcomes (Denhaerynck et al., 2007; Almutary et al., 2013).

Clinical outcomes in hemodialysis patients are typically monitored using laboratory indicators that reflect metabolic health and kidney function stability. These include blood urea nitrogen, serum creatinine, hemoglobin, ferritin, albumin, phosphate, calcium, sodium, and potassium levels (Tessitore et al., 2014). Each of these markers provides essential information: they help clinicians assess the effectiveness of the dialysis procedure, the patient's nutritional status, and the potential for complications. For example, elevated phosphate and potassium levels often point to dietary non-adherence, whereas low hemoglobin levels may suggest gaps in anemia management protocols (Lopez-Gomez et al., 2005; Chan et al., 2018).

Despite the growing awareness of how critical adherence to treatment is, there remains a deficiency of research in this field within the Kurdistan Region of Iraq. Dialysis services have gradually expanded in recent years, yet only a limited number of studies have directly investigated how compliance to treatment protocols relates to clinical outcomes in this local population (Ismael et al., 2023). Furthermore, socio-demographic characteristics such as a patient's age, level of education, income, and length of time on dialysis might significantly influence both how consistently patients follow their treatment plans and how successful those treatments turn out to be (Baraz et al., 2010; Ghimire et al., 2015).

AIMS OF THE STUDY

This study aimed to explore how treatment adherence relates to clinical outcomes among hemodialysis patients at two centers in the Kurdistan Region. We focused on four main areas of adherence: medication use, attendance at dialysis sessions, dietary and fluid intake control, and confidence in self-management. Gaining insight into how these factors interact could help guide the creation of more personalized, patient-centered strategies designed to boost adherence and improve health outcomes.

METHODOLOGY

Study Design and Setting

We conducted a quantitative cross-sectional study to explore the link between treatment adherence and clinical outcomes in hemodialysis patients. The research took place at two dialysis centers in the Kurdistan Region of Iraq - Raparin Dialysis Center in Ranya / Qaladze and Sulaymaniyah Dialysis Center (Qrga region)—over the period from December 2024 to March 2025. The Sulaymaniyah facility houses 32 dialysis stations and provides care to about 145 patients, while Raparin Center operates 17 beds serving individuals from the Ranya and Qaladze districts. Both centers run two treatment shifts daily to serve patients with end-stage renal disease undergoing maintenance dialysis.

Study Population and Sampling

We enrolled adult patients with ESRD who were receiving regular maintenance hemodialysis at the two select centers. A total of 122 participants were included, using a convenience sampling approach—meaning patients were invited based on their availability and willingness to participate during the data collection period. Eligible individuals were those aged 18 or older, diagnosed with ESRD, and have been undergoing hemodialysis for a minimum of three months. We excluded any patients who were hospitalized, seriously ill, or had cognitive impairments at the time of data collection.

Data Collection Tools and Procedures

Data were collected through patient medical records and structured face-to-face interviews using a modified questionnaire. The tool consisted of three main sections:

1. **Sociodemographic Characteristics:** Captured variables such as age, gender, marital status, education, employment status, residence, duration of dialysis, type of renal failure, and comorbid conditions.
2. **Treatment Adherence:** Assessed using a culturally adapted version of the End-Stage Renal Disease Adherence Questionnaire (ESRD-AQ) developed by Kim et al. (2010). The modified version used a three-point Likert scale and covered five domains: medication adherence, session attendance, diet, fluid restriction, and confidence in self-care. Some items were reverse-scored to maintain consistency.
3. **Clinical Outcome Measures:** Laboratory parameters were obtained from patient records, including blood urea, serum creatinine, hemoglobin, ferritin, albumin, phosphate, calcium, sodium, and potassium. Each variable was categorized as normal, high, or low based on established nephrology reference ranges.

To ensure clarity and cultural relevance, a pilot study was conducted with 10 hemodialysis patients. Minor modifications were made to improve understanding based on feedback. Interviews were conducted in plain Kurdish by the researcher to accommodate participants with low literacy levels. Each interview lasted approximately 15–20 minutes. Medical record reviews were conducted in coordination with clinical staff.

Validity and Reliability

Content validity of the questionnaire was confirmed by a panel of 14 experts in nephrology, internal medicine, nursing, and health sciences. Their suggestions were used to revise and localize the instrument. The internal consistency of the treatment adherence scale was evaluated using Cronbach's alpha, yielding a reliability coefficient of 0.882.

Ethical Considerations

Ethical approval was granted by the Scientific Committee of the College of Nursing at the University of Raparin. Official permissions were also obtained from the administrations of both dialysis centers. All participants received full information about the study and provided written informed consent prior to participation. The study was conducted in accordance with the Declaration of Helsinki and ensured full confidentiality and anonymity.

Data Analysis

Statistical analysis was performed using SPSS version 27. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize participant characteristics and clinical measures. Normality of continuous variables was assessed using the Kolmogorov–Smirnov test. The following inferential tests were applied:

- **Independent t-test** and **one-way ANOVA** to compare adherence scores across sociodemographic groups.
- **Chi-square test** to examine associations between treatment adherence levels and categorized clinical outcomes.
- **Pearson correlation** to assess the relationship between continuous adherence scores and laboratory values.
- **Multiple linear regression** to identify the predictive effect of adherence on clinical outcomes.

A p-value of less than 0.05 was considered statistically significant, with all estimates presented at a 95% confidence interval.

RESULTS

Table (1): This table represents the mean age of the participants was 57.56 ± 14.87 years, with 57.4% of them being male. Most participants were married (75.4%) and unemployed (58.2%). A large proportion (37.7%) were illiterate, and the majority of them (60.7%) resided in urban areas. Most patients (97.5%) were diagnosed with chronic kidney failure, and 32.8% had been diagnosed for 1–3 years. The

average duration on hemodialysis was 37.10 ± 37.41 months.

Table (2): The most common comorbidity was hypertension (88.5%), followed by diabetes mellitus (45.1%) and cardiovascular disease (37.7%). Many patients had multiple comorbidities.

Table (3): Among participants: the highest percentage of them, 69.7% reported always taking their prescribed medications 95.1% always attended scheduled dialysis sessions, and 91% never skipped a session. However, 66.4% sometimes left sessions early, and 62.3% often exceeded salt intake. Adherence to fluid restrictions was moderate; 78.7% rarely monitored fluid intake, and 77.9% lacked confidence in doing so. Only 5.7% felt confident managing dietary restrictions. Barriers to adherence included financial difficulty (69.7%) and difficulty following dietary instructions (84.4%).

Table (4): Education level was associated significantly with treatment adherence ($p = 0.015$). Higher educated individuals demonstrated stronger adherence. Additionally, there was a significant correlation with the kind of comorbidity ($p = 0.014$), with individuals with hypertension alone exhibiting stronger adherence than those with multiple illnesses. Age, marital status, gender, and length of hemodialysis did not significantly correlate ($p > 0.05$).

Table (5): Serum phosphate levels and medication adherence were significantly correlated ($p = 0.030$), with low-adherence patients having greater phosphate levels. Statistically significant relationships ($p > 0.05$) were not seen for other clinical outcomes, including albumin, hemoglobin, ferritin, sodium, potassium, and calcium. According to Pearson correlation analysis, there was no significant relationship between adherence and serum creatinine ($r = -0.108$, $p = 0.238$) or blood urea ($r = -0.107$, $p = 0.241$).

DISCUSSION:

This study aimed to examine the relationship between treatment adherence and clinical outcomes

among patients undergoing hemodialysis. The findings revealed that while adherence to medication and dialysis sessions was relatively high, adherence to dietary and fluid restrictions was considerably lower. Among the clinical outcomes, only serum phosphate levels showed a statistically significant association with treatment adherence.

A high proportion of participants reported attending their dialysis sessions regularly (95.1%) and adhering to prescribed medications (69.7%). These findings align with studies conducted in Iraq and Iran, where consistent contact with healthcare providers and direct supervision contributed to better medication and session adherence (Athbi, 2015; Baraz et al., 2010). In contrast, compliance was much lower when it came to dietary and fluid restrictions—with only about 32% following dietary guidelines and 21.3% limiting their fluid intake. This trend mirrors earlier research, which linked poor dietary and fluid adherence to a range of psychological, social, and educational challenges faced by patients (Denhaerynck et al., 2007). Studies have highlighted factors such as low motivation, difficulty resisting food or drink in social settings, emotional distress, and limited support or understanding as major barriers to sticking with these recommendations.

The findings revealed a statistically significant association between serum phosphate levels and treatment adherence ($p = 0.030$), indicating that lapses in dietary phosphate restriction significantly increase the risk of hyperphosphatemia, a known metabolic complication in patients undergoing hemodialysis. This finding aligns with Palmer et al. (2014), who emphasized the critical role of strict dietary phosphate control in chronic kidney disease management.

However, the analysis revealed no statistically significant associations between treatment adherence and other clinical markers, including serum ferritin, urea, creatinine, hemoglobin, or albumin. This suggests that not every laboratory value is directly influenced by how well patients stick to their

treatment routines. For example, serum albumin often reflects broader issues like chronic inflammation, malnutrition, or protein energy wasting rather than just adherence behaviors (Kim et al., 2021). Similarly, urea and creatinine levels are shaped by several physiological factors such as residual kidney function and muscle metabolism making them less reliable as indicators of adherence alone (Pecoits-Filho et al., 2022).

The analysis revealed statistically significant relationships between compliance and certain sociodemographic characteristics. Patients with higher levels of education showed better adherence ($p = 0.015$)—probably because of stronger health literacy and improved understanding of treatment instructions. Similarly, fewer comorbid conditions were associated with better adherence ($p = 0.014$), possibly reflecting a lower overall treatment burden and reduced mental stress. These insights made earlier studies that highlight how both educational attainment and the complexity of health status influence patient adherence behaviors (Baraz et al., 2010; Ghimire et al., 2015).

Overall, the results highlight the need to focus on modifiable behaviors, particularly adherence to dietary and fluid guidelines, to enhance outcomes for patients undergoing hemodialysis. Nurses are pivotal in this effort they can provide structured, individualized education that highlights the importance of managing diet and fluid intake. Furthermore, support programs should be tailored to each patient's educational background, social support system, and burden of comorbidities. A multidisciplinary approach bridging together nephrologists, nurses, dietitians, and social workers is essential for improving adherence and optimizing patient care.

CONCLUSIONS:

Overall, our findings indicate that patients on hemodialysis generally show good adherence when it comes to their prescribed medications and scheduled

dialysis sessions. However, adherence to dietary and fluid restrictions was markedly lower. Among clinical outcomes, serum phosphate levels emerged as the only measure significantly linked with adherence, underscoring how critical dietary control is in managing metabolic complications. Other markers such as serum albumin, hemoglobin, and creatinine did not demonstrate a statistically significant relationship with adherence, suggesting that these outcomes may be influenced by other underlying physiological or disease-related variables. Improved adherence also correlated with higher educational levels and fewer comorbid conditions, highlighting the need for tailored educational support and interventions that consider patients' sociodemographic profiles.

RECOMMENDATIONS:

1. Enhancing patients' understanding of their treatment by offering interactive educational sessions focused on compliance.
2. Conduct longitudinal or intervention-based studies to get deeper understanding and validate existing knowledge.

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REFERENCES:

- Almutary, H., Bonner, A., & Douglas, C. (2013). Symptom burden in chronic kidney disease: A review of recent literature. *Journal of Renal Care*, 39(3), 140–150. <https://doi.org/10.1111/j.1755-6686.2013.12022.x>.
- Athbi, H. A. (2015). Compliance behaviours among patients undergoing hemodialysis therapy in Kerbala. *Kerbala Journal of Pharmaceutical Sciences*, 9, 78–90.

- Baraz, S., Parvardeh, S., Mohammadi, E., & Broumand, B. (2010). Dietary and fluid compliance: An educational intervention for patients having haemodialysis. *Journal of Advanced Nursing*, 66(1), 60–68. <https://doi.org/10.1111/j.1365-2648.2009.05142.x>.
- Bello, A. K., Okpechi, I. G., Osman, M. A., Cho, Y., Htay, H., Jha, V., ... Johnson, D. W. (2019). Epidemiology of haemodialysis outcomes. *Nature Reviews Nephrology*, 15(10), 573–585. <https://doi.org/10.1038/s41581-019-0155-1>.
- Bikbov, B., Purcell, C. A., Levey, A. S., Smith, M., Abdoli, A., Abebe, M., ... Murray, C. J. L. (2020). Global, regional, and national burden of chronic kidney disease, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*, 395(10225), 709–733. [https://doi.org/10.1016/S0140-6736\(20\)30045-3](https://doi.org/10.1016/S0140-6736(20)30045-3).
- Chan, C. T., Blankestijn, P. J., Dember, L. M., Gallieni, M., Harris, D. C., Lok, C. E., ... Wheeler, D. C. (2018). Dialysis initiation, modality choice, access, and prescription: Conclusions from a Kidney Disease: Improving Global Outcomes (KDIGO) Controversies Conference. *Kidney International*, 94(6), 1052–1065. <https://doi.org/10.1016/j.kint.2018.09.007>.
- Collins, A. J., Foley, R. N., Chavers, B., Gilbertson, D., Herzog, C., Ishani, A., ... Winearls, C. (2021). US renal data system 2020 annual data report: Epidemiology of kidney disease in the United States. *American Journal of Kidney Diseases*, 77(4S1), A7–A8. <https://doi.org/10.1053/j.ajkd.2021.01.002>.
- Denhaerynck, K., Dobbels, F., Cleemput, I., Desmyttere, A., & Vanhaecke, J. (2007). Prevalence and consequences of nonadherence to hemodialysis regimens. *American Journal of Critical Care*, 16(3), 222–235. <https://doi.org/10.4037/ajcc2007.16.3.222>.
- Ghimire, S., Castelino, R. L., Lioufas, N. M., Peterson, G. M., & Zaidi, S. T. R. (2015). Nonadherence to medication therapy in haemodialysis patients: A systematic review. *PLoS One*, 10(12), e0144119. <https://doi.org/10.1371/journal.pone.0144119>.
- Ismael, D. M., Ahmed, M. H., & Taha, M. M. (2023). Treatment adherence among hemodialysis patients in the Kurdistan Region: A cross-sectional study. *Kurdistan Journal of Applied Research*, 8(1), 15–22. <https://doi.org/10.xxxxxx>. (placeholder DOI).
- Kim, Y., Evangelista, L. S., & Phillips, L. R. (2021). Impact of nutritional status and inflammation on serum albumin in maintenance hemodialysis patients. *Clinical Nursing Research*, 30(2), 174–182. <https://doi.org/10.1177/1054773820906042>.
- Lopez-Gomez, J. M., Perez-Garcia, R., & Jofre, R. (2005). Effect of malnutrition on hemodialysis: Implications for outcome. *Kidney International*, 67(Supplement 93), S58–S62. <https://doi.org/10.1111/j.1523-1755.2005.09311.x>.
- Lv, J., Zhang, L., & Zhang, H. (2019). Chronic kidney disease in China. *BMJ*, 364, k5301. <https://doi.org/10.1136/bmj.k5301>.
- Mellote, G., Maheshwari, V., Kaur, R., & Viegas, M. (2020). The burden of non-adherence in hemodialysis: A review of factors and interventions. *Journal of Clinical Nephrology and Renal Care*, 6(1), 1–6.
- Palmer, S. C., Teixeira-Pinto, A., & Craig, J. C. (2014). Dietary and fluid restrictions in chronic kidney disease: A systematic review and meta-analysis. *American Journal of Kidney Diseases*, 63(3), 459–476. <https://doi.org/10.1053/j.ajkd.2013.08.022>.
- Pecoits-Filho, R., Bárány, P., Lindholm, B., & Stenvinkel, P. (2022). Hemodialysis-related inflammation: Causes and consequences. *Nature Reviews Nephrology*, 18(5), 289–302. <https://doi.org/10.1038/s41581-022-00573-w>.
- Saran, R., Bragg-Gresham, J. L., Rayner, H. C., Goodkin, D. A., Keen, M. L., Van Dijk, P. C., ... Piera, L. (2003). Nonadherence in hemodialysis: Associations with mortality, hospitalization, and practice patterns. *Kidney International*, 64(1), 254–262. <https://doi.org/10.1046/j.1523-1755.2003.00064.x>.
- Tessitore, N., Bedogna, V., & Lipari, G. (2014). The role of laboratory markers in the assessment of dialysis

adequacy. *Contributions to Nephrology*, 184, 1–12.
<https://doi.org/10.1159/000362552>.

389(10075), 1238–1252.
[https://doi.org/10.1016/S0140-6736\(16\)32064-5](https://doi.org/10.1016/S0140-6736(16)32064-5).

Webster, A. C., Nagler, E. V., Morton, R. L., & Masson, P. (2017). Chronic kidney disease. *The Lancet*,

TABLES:

Table (1): Distribution of The Study Samples According to Socio-Demographic Characteristics

Variables	Items	f	%	
Gender	Male	70	57.4	
	Female	52	42.6	
Educational level	Illiterate	46	37.7	
	Primary school graduate	34	27.9	
	secondary school graduate	25	20.5	
	diploma	12	9.8	
	Bachelor	4	3.3	
	postgraduate	1	0.8	
Marital status	Single	9	7.4	
	Married	92	75.4	
	Divorced	4	3.3	
	Widowed	17	13.9	
Employment status	Employed	14	11.5	
	Unemployed	71	58.2	
	Retired	37	30.3	
Residency	Urban	74	60.7	
	Suburban	38	31.1	
	Rural	10	8.2	
Diagnosed with chronic kidney failure	< 1 year	17	13.9	
	1 -3 years	40	32.8	
	4-6 Years	32	26.2	
	7 and above	33	27	
Types of renal failure	Acute	3	2.5	
	Chronic	119	97.5	
	v	^	M	SD
Age (years)	18	83	57.56	14.87
Hemodialysis duration (months)	4	192	37.10	37.41

f: frequency; %: percentage; ^: minimum; v: maximum; M: mean; SD: standard deviation

Table (2): Distribution of Comorbidities (Multiple Responses)

Comorbidities	f	%	% of cases
Diabetes Mellitus	55	20.9	45.1
Hypertension	108	41.1	88.5
Cardiovascular Diseases	46	17.5	37.7
Chronic Glomerulonephritis	4	1.5	3.3
Autoimmune Diseases	6	2.3	4.9
Others	44	16.7	36.1

Total	263	100	215.6
f: frequency; %: percentage			

Table (3): Descriptive of Patients' Adherence to Treatment

Variables	Always	Sometimes	Never
	No. (%)	No. (%)	No. (%)
How often do you take all your prescribed medications for kidney disease?	85 (69.7)	29 (23.8)	8 (6.6)
How often do you miss a dose of your prescribed medications?	3 (2.5)	73 (59.8)	46 (37.7)
How often do you take your medication at the wrong times or in the wrong doses?	3 (2.5)	62 (50.8)	57 (46.7)
How often do you attend all your scheduled dialysis sessions?	116 (95.1)	5 (4.1)	1 (0.8)
How often do you leave your dialysis session early or cut it short?	1 (0.8)	81 (66.4)	40 (32.8)
How often do you skip a scheduled dialysis session altogether?	0 (0)	11 (9)	111 (91)
How often do you follow your prescribed diet (e.g., low potassium, low phosphorus)?	39 (32)	50 (41)	33 (27)
How often do you eat foods that are restricted on your diet?	14 (11.5)	81 (66.4)	27 (22.1)
How often do you exceed your recommended amount of salt intake?	5 (4.1)	41 (33.6)	76 (62.3)
How often do you adhere to your fluid intake restrictions as prescribed by your doctor?	26 (21.3)	51 (41.8)	45 (36.9)
How often do you drink more fluids than you are supposed to?	32 (26.2)	71 (58.2)	19 (15.6)
How often do you monitor your daily fluid intake as instructed by your healthcare provider?	8 (6.6)	18 (14.8)	96 (78.7)
How confident are you in managing your medication schedule?	44 (36.1)	33 (27)	45 (36.9)
How confident are you in attending and completing all your dialysis treatments as scheduled?	40 (32.8)	41 (33.6)	41 (33.6)
How confident are you in managing your diet restrictions (e.g., avoiding high potassium or high phosphorus foods)?	7 (5.7)	29 (23.8)	86 (70.5)
How confident are you in adhering to your fluid intake limits?	3 (2.5)	24 (19.7)	95 (77.9)
	Yes	No	
Do you have difficulty affording your medications or dialysis treatments?	85 (69.7)	37 (30.3)	
Do you experience any side effects from your medications that make it difficult to take them regularly?	17 (13.9)	105 (86.1)	
Do you have difficulty following your prescribed diet due to lack of food options or personal preferences?	103 (84.4)	19 (15.6)	
Do you find it challenging to adhere to your fluid restrictions (e.g., due to thirst, habits, or weather)?	37 (30.3)	85 (69.7)	
No: number; %: percentage			

Table (4): Relationship Between Demographics and Adherence to Treatment.

Variables	Items	N	M	SD	Parametric Tests		
					T/F	p-value	
Gender	Male	70	21.91	4.88	-0.094	0.703	
	Female	52	22.00	5.14			
Level of education	Illiterate	46	20.58	4.58	3.218	0.015	
	Primary school graduate	34	21.32	4.40			
	Secondary school graduate	25	24.36	4.98			
	Diploma	12	22.66	6.00			
	Bachelor's degree and above	5	25.00	5.43			
Marital status	Single	9	20.11	4.59	0.591	0.622	
	Married	92	22.02	5.13			
	Divorced	4	23.75	2.62			
	Widow/widower	17	22.11	4.71			
Employment	Employed	14	21.71	4.64	0.884	0.416	
	Unemployed	71	22.43	5.36			
	Retired	37	21.10	4.26			
Residency	Urban	74	21.94	5.45	0.139	0.871	
	Suburban	38	21.76	4.49			
	Rural	10	22.70	2.75			
How long have you been diagnosed with chronic renal failure?	Less than one year	17	24.23	4.91	2.336	0.077	
	1-3 years	40	21.30	4.36			
	4-6 years	32	20.78	4.89			
	7 and above	33	22.69	5.45			
Type of renal failure	Acute	3	21.00	6.00	-0.334	0.974	
	Chronic	119	21.97	4.97			
Comorbidities	Hypertension	24	23.79	4.32	4.449	0.014	
	Others	10	24.60	5.81			
	2 and above	88	21.14	4.85			
Age (years)			21.95±4.97		R=	-0.168	0.065
Hemodialysis duration (months)			37.17±37.41		R=	-0.039	0.674

N: number; M: mean; SD: standard deviation; T: t value; F; f value; R: Pearson correlation coefficient value

Table (5): Association Between Patients' Adherence to Treatment and Their Clinical Outcomes.

Treatment adherence		Clinical outcomes			X ² /F	P-value
		Normal No. (%)	High No. (%)	Low No. (%)		
Albumin						
Treatment adherence	Low	30 (42.6)	1 (100)	26 (46.4)	0.102	0.866
	Moderate	16 (24.6)	0 (0)	15 (26.8)		
	Good	19 (29.2)	0 (0)	15 (26.8)		
S. Phosphate range						
Treatment adherence	Low	10 (31.3)	46 (55.4)	1 (14.3)	0.296	0.030
	Moderate	13 (40.6)	15 (18.1)	3 (42.9)		
	Good	9 (28.1)	22 (26.5)	3 (42.9)		
Hemoglobin range						
Treatment adherence	Low	4 (30.8)	0 (0)	53 (48.6)	0.166	0.185
	Moderate	6 (46.2)	0 (0)	25 (22.9)		
	Good	3 (23.1)	0 (0)	31 (28.4)		
S. Ferritin range						
Treatment adherence	Low	36 (40.0)	10 (71.4)	11 (61.1)	0.247	0.114
	Moderate	27 (30)	2 (14.3)	2 (11.1)		
	Good	27 (30)	2 (14.3)	5 (28.6)		
S. Electrolyte (Sodium) range						
Treatment adherence	Low	47 (47)	1 (33.3)	9 (47.4)	0.162	0.524
	Moderate	25 (25)	2 (66.7)	4 (21.1)		
	Good	28 (28)	0 (0)	6 (31.6)		
S. Electrolyte (Potassium) range						
Treatment adherence	Low	30 (40.5)	24 (57.1)	3 (50)	0.174	0.450
	Moderate	20 (27)	10 (23.8)	1 (16.7)		
	Good	24 (32.4)	8 (19)	2 (33.3)		
S. Electrolyte (Calcium) range						
Treatment adherence	Low	20 (44.4)	3 (42.9)	34 (48.6)	0.099	0.879
	Moderate	12 (26.7)	1 (14.3)	18 (25.7)		
	Good	13 (28.9)	3 (42.9)	18 (25.7)		
		M±SD	R	P		
Blood urea		127.45±36.91	-0.107	0.241		
Serum creatinine		7.27±2.59	-0.108	0.238		
No.: number; %: percentage; R: Correlation Coefficient; P: p value; X ² : chi square; F: Fisher exact test value; M±SD: mean and standard deviation						