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Effectiveness of a Nurse-Led Interventions on Dietary and Fluid Adherence among Patients with Hemodialysis

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ABSTRACT:

Background: Adapting lifestyle behaviors through appropriate regulation of dietary and fluid intake is a fundamental component in caring for patients with end-stage renal disease (ESRD) receiving hemodialysis. However, maintaining adherence to prescribed dietary and fluid restrictions remains a persistent daily challenge for many patients and may adversely affect treatment outcomes.

Objective(s): Hemodialysis patients require strict adherence to dietary and fluid restrictions to prevent serious metabolic and cardiovascular complications. However, The present study was conducted to evaluate the effectiveness of a nurse-led interventions on adherence to dietary and fluid among adults with hemodialysis.

Methods: A quasi-experimental pre-posttest design was conducted from November 2025 to February 2026 at the Dialysis Unit of the Renal Disease and Transplantation Center, Al-Najaf Al-Ashraf City/Najaf Health Directorate. A non-probability consecutive sample of 80 patients undergoing hemodialysis was recruited for the study. Data were collected using a validated dietary and fluid adherence questionnaire. The collected data were analyzed using descriptive statistics through the Statistical Package for the Social Sciences (SPSS), version 26.

Result: One month after the implementation of the intervention, the study group demonstrated a significantly higher total adherence score than the control group. The nurse-led intervention was associated with an improvement in patients' adherence, with overall adherence shifting from a low to a moderate level, while the proportion of patients achieving good adherence was greater in the study group. Furthermore, participants in the intervention group showed significantly lower serum phosphorus (4.16 ± 0.66 vs. 6.93 ± 1.21 mg/dL), serum potassium (5.17 ± 0.66 vs. 6.74 ± 1.08 mmol/L), and interdialytic weight gain compared with those in the control group. Collectively, these findings indicate that nurse-led interventions are effective in enhancing adherence behaviors and improving selected clinical outcomes among patients undergoing hemodialysis.

Conclusion: The results of this study indicate that nurse-led interventions enhance adherence among hemodialysis patients and improve selected clinical indicators.

INTRODUCTION

Chronic kidney disease (CKD) is a significant global public health problem, affecting more than 850 million individuals worldwide (Ortiz et al., 2025). It is characterized by irreversible and persistent damage to the renal parenchyma, resulting in a gradual decline in kidney function over time. As a major non-communicable disease, CKD imposes a substantial burden on healthcare systems and is associated with an elevated risk of cardiovascular complications, premature mortality, and poor quality of life. Disease progression may ultimately lead to end-stage kidney disease (ESKD), where renal function is severely reduced. At this advanced stage, renal replacement therapy, including dialysis or kidney transplantation, becomes essential to maintain life and improve patient survival (Zoccali et al., 2023; Karimi et al., 2023).

End-stage kidney disease (ESKD) is clinically defined as a glomerular filtration rate (GFR) below 15 mL/min/1.73 m², reflecting severely impaired renal function (Provenzano et al., 2024). It represents a major global public health concern and imposes a substantial economic burden on healthcare systems and society because of the long-term need for renal replacement therapy (Stevens et al., 2024). In Iraq, a nationwide study by Ismael et al. (2025) reported that 10,721 patients were receiving maintenance hemodialysis, representing the treated prevalence of end-stage renal disease (ESRD) in the country. These findings highlight the considerable burden of ESRD and the increasing demand for renal replacement therapy.

Globally, hemodialysis (HD) remains the leading modality of kidney replacement therapy, representing about 69% of all kidney replacement therapies and nearly 89% of dialysis treatments performed worldwide (Bello *et al.*, 2022). Besides receiving regular dialysis sessions, patients are required to adhere to recommended dietary guidelines, fluid restrictions, and prescribed medications to achieve the best possible clinical outcomes (Ansaf & Al-Hamadani, 2025). According to Al-Khattabi *et al.* (2023), adherence describes the extent to which patients' behaviors, including medication-taking, dietary practices, and lifestyle modifications, are aligned with the advice and recommendations provided by healthcare professionals. Adequate adherence is also considered a key component of effective hemodialysis, as it contributes to better therapeutic outcomes and helps reduce complications, disability, and mortality among patients undergoing dialysis (Sabouri *et al.*, 2023).

The recorded prevalence of non-adherence among patients undergoing hemodialysis(HD) varies widely, ranging from 22% to 74%. Non-adherence to (HD) regimens may associated with numerous metabolic and cardiovascular complications. Moreover, the risk of hospitalization increases due to non-adherence to dietary, fluid, and medication treatments. As a result, it contributes to higher mortality rates, increased utilization of healthcare services and decreased quality of life among patients undergoing(HD) (Abdul-Jabbar & Kadhim, 2022).

Nurse-led intervention is defined as a healthcare approach in which registered nurses play a central role in planning, implementing, and overseeing various aspects of patient care and treatment. These interventions are founded on the expertise, knowledge, and skills of the nursing profession. They may be delivered across a variety of healthcare settings, including hospitals, community clinics, health centers, and patients' homes. In recent years, nurse-led self-management interventions have gained increasing attention as effective strategies that promote patient education, empowerment, and active participation in care (Qiu, 2024; Bulto & Hendriks, 2024).

Nephrology nurses are in an excellent position to assess and enhance adherence among hemodialysis patients because they prolonged contact with patients compared with other healthcare professionals. The role of nurses is vital in educating and sporting patients to adapt to new lifestyle modifications (Mahmoud Sofar *et al.*, 2025). Nurses also provide patients with educational resources such as pamphlets, fact sheets, and food lists, in addition to continuous education programs that assist patients in managing their dietary and fluid prescriptions. Therefore, nurses must establish individualized strategies for dietary and fluid management to enhance adherence among patients undergoing hemodialysis (Duzalan *et al.*, 2021).

Adherence to multifaceted therapeutic regimens remains a significant challenge for patients receiving hemodialysis worldwide. In developing countries, this burden is further intensified due to limited healthcare resources, financial constraints, and inadequate social support systems. Therefore, addressing the multidimensional needs and experiences of hemodialysis patients may contribute to improving their overall health outcomes and well-being. Accordingly, this study aims to evaluate the effectiveness of nurse-led interventions on dietary and fluid adherence among adult patients undergoing hemodialysis.

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METHODOLOGY

2.1. Design of the Study

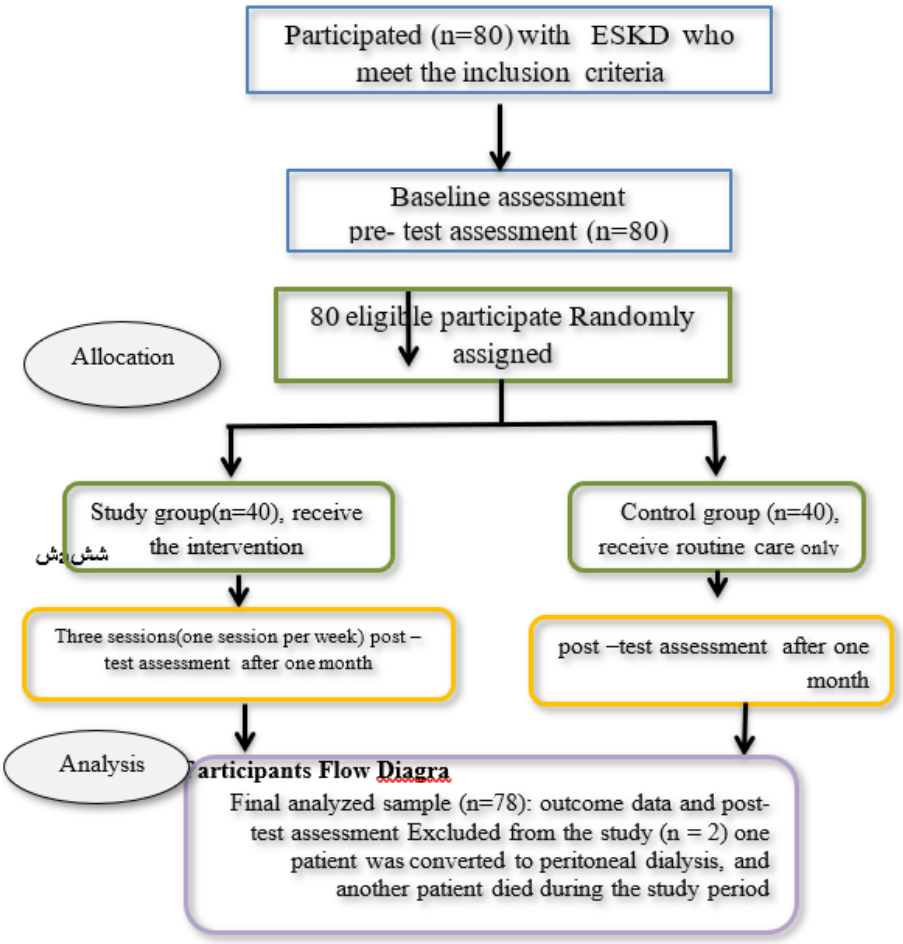
This study adopted a quasi-experimental pretest–posttest design involving an intervention group and a control group to evaluate the effectiveness of a nurse-led intervention on dietary and fluid adherence among patients undergoing hemodialysis.

2.2. Setting of the Study

Al-Najaf Al-Ashraf City / Najaf Health Directorate / Renal Disease and Transplantation Center.

2.3. Sample and Sampling

A non-probability consecutive sampling technique was employed to recruit 80 eligible patients for this study. Participants were enrolled based on predefined inclusion criteria, including adults aged 18–65 years diagnosed with end-stage renal disease (ESRD) who had been undergoing maintenance hemodialysis for at least three months. Patients with communication difficulties that could interfere with answering the study questionnaire, such as cognitive impairment or severe physical frailty, were excluded.After recruitment, participants were randomly assigned to either the intervention group (n = 40) or the control group (n = 40) using a simple randomization technique to ensure an equal allocation. The intervention group received the nurse-led interventions whereas the control group continued to receive routine care only**. As shown in Flowchart 2.1**



Flowchart (2.1): Participants Flow Diagram

2.4. Data Collection

Data were collected using constructed questionnaire developed by the researcher based on a preliminary assessment and thematic analysis of hemodialysis patients' adherence-related problems. The questionnaire was constructed after an extensive review of the relevant literature and previous studies concerning dietary and fluid adherence among patients undergoing hemodialysis. The preliminary assessment was conducted to identify the most common adherence difficulties experienced by patients during hemodialysis treatment. Thematic analysis was subsequently applied to organize and classify the identified issues into major themes, which were used to formulate the questionnaire items. The final instrument was structured into four main parts. The first part comprised participants' socio-demographic characteristics, including age, sex, educational level, marital status, occupation, monthly family income, and place of residence.

The second part clinical characteristics, including duration of hemodialysis, number of weekly dialysis sessions, intradialytic weight gain, dry weight, pre-dialysis body weight, smoking status, and selected laboratory parameters (serum creatinine, phosphorus, and potassium level).

The third part assessed dietary adherence through 15 items covering key dimensions such as meal timing, portion control, avoidance of restricted foods (high potassium, phosphorus, sodium, and inappropriate protein intake), meal planning, adherence during social occasions, self-monitoring practices, and awareness of dietary impact on health outcomes.

The fourth part evaluated fluid adherence through 15 items addressing fluid restriction, self-monitoring of intake, behavioral management in daily and social contexts, adherence to prescribed fluid allowances, awareness of complications of excess fluid intake, and recognition of fluid overload sign.

2.5. Validity and Reliability

Content validity was evaluated to ensure that the instrument accurately measures the intended concepts. A panel of 14 experts in nursing and medicine reviewed the questionnaire, assessing each item for clarity, relevance, and comprehensiveness. Based on their feedback, necessary revisions were made to enhance the quality of the instrument. The experts evaluated the content validity index (CVI) of the instruments was assessed on a four-point scale; 4 = this item is essential, 3 = this item is useful, 2 = this item is relevant, 1 = this item is irrelevant . overall S-CVI/Ave for the 15 item scale Fluid adherence was (0.97),and the overall S-CVI/Ave for the 15-item scale dietary adherence was (0.97) indicating that the majority of items collectively and accurately represent the intended structure.

Reliability statistics indicate that Cronbach's alpha coefficient The internal consistency of the 15-items of Dietary adherence was Cronbach's alpha = 0.75and of the 15-items of Fluid adherence was Cronbach's alpha = 0.78 .A pilot study was conducted with a sample 10 patients who met the study criteria at center to assess the clarity and suitability of the instrument before full implementation. The pilot study sample was excluded from the main study sample.

2.6. Ethical Considerations

The researcher obtained approval from the medical ethics committee/college of medicine/university of Kufa before conducting the study (MEC=239).additional approval was also obtained from the nephrology and renal transplantation Renal Disease and Transplantation center at al-Sadder medical city.

2.3. Data Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 26. Descriptive statistics were used to summarize the data and included frequencies, percentages, means, standard deviations, and ranges (minimum and maximum values), as appropriate. Associations between categorical variables were examined using the Chi-square test when its underlying assumptions were satisfied. Statistical significance was determined at a p-value of ≤ 0.05. Box plots were created using GraphPad Prism, version 8, to illustrate the distribution of the study data.

2.7. Nurse-led intervention

The nurse-led intervention was delivered through three structured educational sessions conducted by the researcher. Each session was designed to address a specific aspect of adherence and self-management among hemodialysis patients.

The first session focused on enhancing patients' knowledge regarding chronic kidney disease, hemodialysis, and the

importance of adherence to prescribed therapeutic recommendations. The second session addressed dietary management and fluid restriction, with emphasis on appropriate food selection, control of potassium and phosphorus intake, and strategies for monitoring daily fluid consumption.

The third session focused on promoting healthy self-care behaviors, prevention of hemodialysis-related complications, and overcoming common barriers affecting adherence. To support patients' understanding and engagement, several educational materials and practical tools were utilized throughout the intervention, including an illustrated educational booklet, graduated cups for fluid measurement, and food guidance lists.

3.RESULT

Table (1) presents the demographic characteristics of the intervention (n = 40) and control (n = 38) groups. Baseline comparisons showed no statistically significant differences between the two groups with respect to age, sex, educational level, marital status, employment status, or place of residence ($p > 0.05$). However, a statistically significant difference was identified in monthly family income ($\chi^2 = 8.916$, $p = 0.012$), with a greater proportion of participants in the control group reporting lower monthly income. Table (2) describes the clinical characteristics of participants in both groups. The intervention and control groups were comparable regarding the duration of hemodialysis treatment and the frequency of dialysis sessions per week, as no statistically significant differences were detected ($p > 0.05$). Figures (2) and (3) illustrate the effect of the intervention on biochemical parameters in both groups. In the study group, serum potassium and phosphorus levels decreased significantly after the intervention ($p < 0.0001$), indicating improved adherence and dialysis-related outcomes, while serum creatinine showed no significant change within the study group. In contrast, the control group demonstrated no improvement in serum phosphorus, whereas serum potassium and creatinine levels increased significantly at post-test. Table (3) demonstrates a significant enhancement in fluid adherence among the study group following the intervention. At pre-test, most participants showed low adherence (97.5%) with a mean score of 0.17 ± 0.11, whereas post-test results indicated that all participants (100%) achieved moderate adherence with an increased mean score of 0.49 ± 0.08. In contrast, the control group remained at low adherence levels in both pre-test and post-test, with minimal change in mean scores (0.13 ± 0.08 vs. 0.13 ± 0.1). Table (4) indicates a notable improvement in dietary adherence among the study group after the intervention. Pre-test findings showed that most participants had low adherence (87.5%) with a mean score of 0.17 ± 0.11, whereas post-test results revealed that 55% achieved moderate adherence and 45% achieved high adherence, with the mean score increasing to 0.69 ± 0.07. Conversely, the control group remained predominantly at low adherence levels during both pre-test and post-test, with mean scores of 0.14 ± 0.09 and 0.11 ± 0.09, respectively.

4.DISCUSSION

Regarding fluid adherence, the present study demonstrated a marked improvement among the study group following the intervention, reflected by reduced IDWG and improved adherence scores. This improvement may be attributed to the effectiveness of the interventions in enhancing patients' awareness regarding fluid restriction and self-management practices. These results are consistent with previous studies (de Souza *et al.*, 2025; Nguyen *et al.*, 2026), that reported These findings are supported by previous studies, which reported that nurse-led self-management and structured interventions effectively improve patients' understanding of kidney disease, enhance self-management behaviors, and promote adherence among hemodialysis patients. Moreover, earlier research demonstrated that nursing interventions can significantly improve laboratory parameters in patients with chronic renal failure, highlighting their important role in improving patient outcomes and the quality of nursing care. The study also revealed significant improvement in dietary adherence among participants in the intervention group. This finding may be explained by increased patient understanding of dietary restrictions, particularly regarding potassium and phosphorus intake, which are essential components of hemodialysis management. These results are corroborated by previous research Dsouza *et al.*(2023), which reported nurse-led interventions may enhance patients' knowledge and adherence by improving the provision of information, reinforcing correct practices, and reducing misconceptions about the disease. Concerning biochemical parameters, significant reductions in serum potassium and phosphorus levels were observed after the intervention, indicating improved adherence and better dialysis-related outcomes. All dialysis providers are required to deliver culturally sensitive, patient-centered care through the application of integrated and effective strategies and protocols. These results are consistent with previous studies (Zeng-Wang *et al.*, 2025; Umeukeje *et al.*, 2018). Optimal adherence to phosphate control is likely to be achieved through multilevel interventions that take into account patients' preferences and individual attitudes, strengthen self-regulation behaviors, and support their empowerment to maintain long-term adherence to phosphate binder therapy. The significant reduction in intradialytic weight gain among the

study group further supports the effectiveness of the intervention in promoting fluid adherence. Lower IDWG is considered an important clinical indicator of adequate fluid management and is associated with improved patient outcomes and decrease dialysis-related complications. According to Bossola *et al.*,(2022) meta-analysis including 18 studies demonstrated that educational and behavioral nursing interventions significantly decrease intradialytic weight gain, with a pooled mean difference of −0.15 kg. Moreover, psychological interventions showed a slightly greater reduction (−0.26 kg), indicating that addressing patients' behavioral and emotional aspects may further enhance adherence to fluid restrictions. These findings support the effectiveness of nurse-led interventions in improving fluid control among patients undergoing hemodialysis.

5.CONCLUSION

Hemodialysis patients, particularly in developing countries, face considerable challenges in adhering to complex treatment regimens due to limited healthcare resources, financial burden, and inadequate social support. This study indicates that structured behavioral interventions can significantly improve adherence to dietary and fluid restrictions, highlighting their potential role in enhancing patient self-management. These findings align with existing evidence assisting the effectiveness of behavioral practices in improving outcomes in chronic diseases such as end-stage renal disease.

Table (1): Statistical Distribution Socio-Demographic Characteristics for Study (n=40) and Control (n=38) Groups of hemodialysis patients.

Demographic Characteristics	Rating and Intervals	Study Group		Control Group		Chi-square (df)	P-value (Sig.)
		F.	%	F.	%		
Age (Years)	<= 30	15	37.50	6	15.79	4.768 (2)	.092 (NS)
	31 – 40	8	20	9	23.68		
	41 and More	17	42.50	23	60.53		
	Mean ±SD (Min. – Max.)	39.8±14.8 (19-65)		39.9±7.1 (21-55)			
Sex	Males	18	45	19	50	.195 (1)	.658 (NS)
	Females	22	55	19	50		
Education Level	Doesn't read and write	4	10	7	18.42	4.276 (6)	.639 (NS)
	Read and write	11	27.50	10	26.32		
	Primary school graduate	17	42.50	15	39.47		
	Intermediate school graduate	6	15	3	7.89		
	Preparatory school graduate	0	0	1	2.63		
	Institute graduated	1	2.50	0	0		
	College or higher studies	1	2.50	2	5.26		
Marital Status	Single	13	32.50	6	15.79	7.430 (3)	.059 (NS)
	Married	22	55	30	78.95		
	Divorced	5	12.50	1	2.63		
	Widowed	0	0	1	2.63		
	Retired	3	7.50	6	15.79		

Employment status	full time student	0	0	0	0	3.651 (4)	.455 (NS)
	Employee	2	5	0	0		
	own work	2	5	3	7.89		
	Housewife	15	37.50	15	39.47		
	Jobless	18	45	14	36.84		
Monthly income of the family	<250,000	16	40	26	68.42	8.916 (2)	.012 (S)
	250,000 -500,000	19	47.50	12	31.58		
	>500,000	5	12.50	0	0		
Residence	Urban	30	75	27	71.05	.154 (1)	.694 (NS)
	Rural	10	25	11	28.95		
Total		40	100%	38	100%		

%= percentage, F. = frequency, min.: minimum, Max.: maximum, SD: standard deviation, d.f = degree of freedom, P = probability value. NS= Non-Significant at (P > 0.05), HS: high significant.

Table (2): Statistical Distribution of Clinical Characteristics for Study (n=40) and Control (n=40) Groups of hemodialysis patients.

Clinical Characteristics	Rating and Intervals	Study Group		Control Group		Chi-square (df)	P-value (Sig.)
		F.	%	F.	%		
	<= 5	25	62.50	38	100		
Duration of Hemodialysis treatment	6 – 10	12	30	0	0	.237^ (76)	.813 (NS)
	11+	3	7.50	0	0		
	Mean ±SD (Min.	4.8±3.9		5±3.9			
	– Max.)	(0.1-20)		(0.3-19)			
Number of dialysis sessions per	1	0	0	1	2.63	2.193^ (76)	.051 (NS)
	2	29	72.50	16	42.11		
	3	11	27.50	21	55.26		
Week	Mean ±SD (Min. – Max.)	2.4±0.5 (2-3)		2.5±0.6 (1-3)			
	>3	29	72.50	27	71.05		
	Mean ±SD (Min. – Max.)	3.7±0.5 (3-4)		3.6±0.5 (3-4)			
Smoking	Yes	1	2.50	2	5.26	.711 (2)	.701 (NS)
	No	37	92.50	33	86.84		
	Former	2	5	3	7.89		
Total		40	100%	38	100%		

%= percentage, F. = frequency, d.f = degree of freedom, P = probability value. ^=Independent t test, NS= Non-Significant at (P > 0.05), HS: high significant.

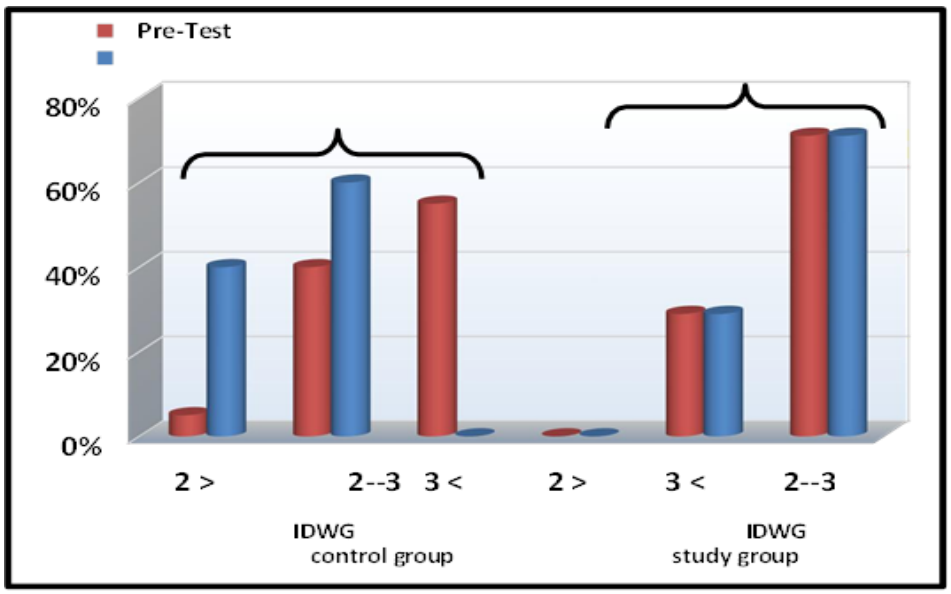
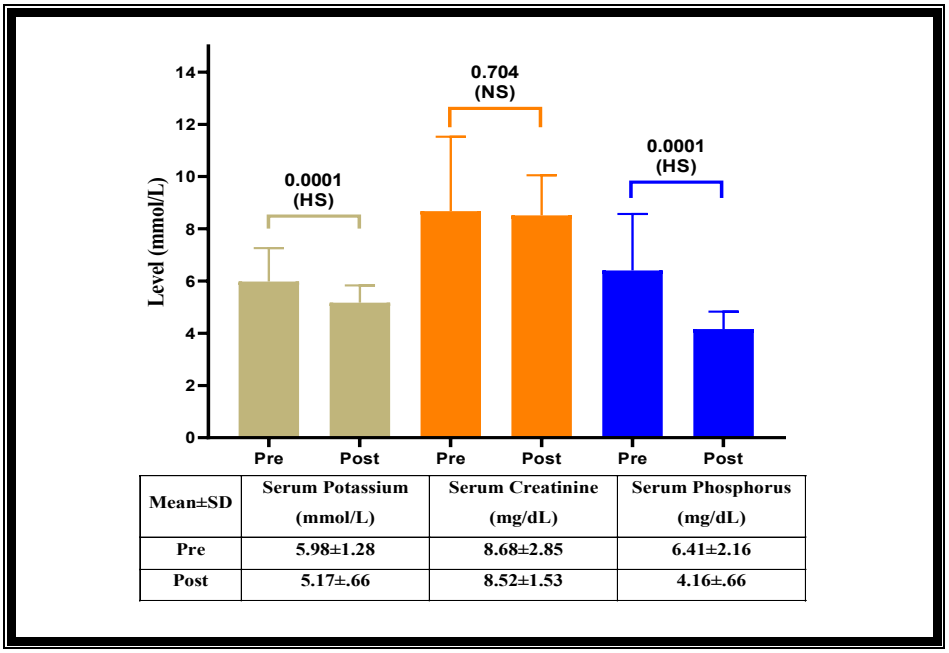


Figure (1): Bar Chart of Intradialytic Weight Gain (IDWG) among hemodialysis patients at the Pre-test and Post-test level for both study and control group



Mean±SD	Serum Potassium (mmol/L)	Serum Creatinine (mg/dL)	Serum Phosphorus (mg/dL)
Pre	5.98±1.28	8.68±2.85	6.41±2.16
Post	5.17±.66	8.52±1.53	4.16±.66

Figure (2): Box Plot of hemodialysis in correcting electrolyte and mineral imbalances among hemodialysis patients at study group.

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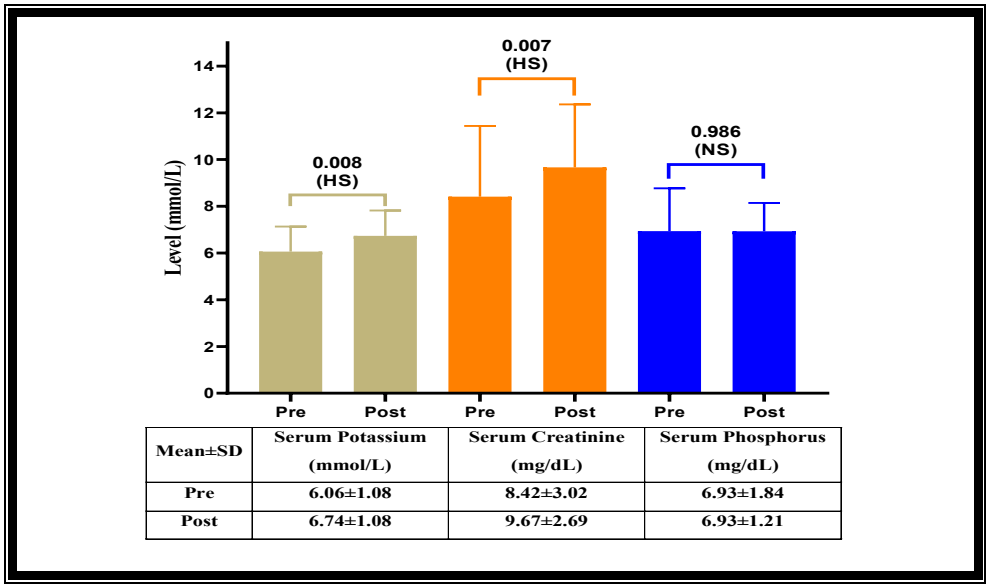

Mean±SD	Serum Potassium (mmol/L)	Serum Creatinine (mg/dL)	Serum Phosphorus (mg/dL)
Pre	6.06±1.08	8.42±3.02	6.93±1.84
Post	6.74±1.08	9.67±2.69	6.93±1.21

Figure (3): Box Plot of hemodialysis in correcting electrolyte and mineral imbalances among hemodialysis patients at control group.

Table (3): Overall Assessment of Fluid Adherence according to Items of Fluid Adherence Scale of hemodialysis patients at the Pre-test and Post-test level.

Overall Items		Study Group (*n*=40)									Control Group (*n*=38)								
		Pre-Test					Post-Test				Pre-Test					Post-Test			
		F.	%	MS	SD	Assess.	F.	%	MS	SD	Assess.	F.	%	MS	SD	Assess.	F.	%	MS	SD	Assess.
Fluid Adherence	Low	39	97.5	.17	.11	Low	0	0	.49	.08	Moderate	37	97.37	.13	.08	Low	38	100	.13	.10	Low
	Moderate	1	2.5				40	100				1	2.63				0	0			
	High	0	0				0	0				0	0				0	0			

%= percentage, F. = frequency, M.S: Mean of score Low (mean of scores <=0.33), Moderate (mean of scores 0.34-0.67), High (mean of scores 0.68 and more), SD: Standard Deviation, Assess.: Assessment.,

Table (4): Overall Assessment of Dietary Adherence according to Items of Dietary Adherence Scale of hemodialysis patients at the Pre-test and Post-test level.

Overall Items		Study Group (*n*=40)									Control Group (*n*=38)								
		Pre-Test					Post-Test				Pre-Test					Post-Test			
		F.	%	MS	SD	Assess.	F.	%	MS	SD	Assess.	F.	%	MS	SD	Assess.	F.	%	MS	SD	Assess.
Dietary Adherence	Low	35	87.50	.16	.11	Low	0	0	.69	.07	High	34	89.47	.14	.09	Low	38	100	.11	.09	Low
	Moderate	5	12.50				22	55				4	10.53				0	0			
	High	0	0				18	45				0	0				0	0			

%= percentage, F. = frequency, M.S: Mean of score, Low (mean of scores <=0.33), Moderate (mean of scores 0.34-0.67), High (mean of scores 0.68 and more), SD: Standard Deviation, Assess.: Assessment.

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