

# Assessing Dietary Adherence in Renal Patients on Hemodialysis: Insights from a Food Frequency Questionnaire

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**Abstract:** *This study investigates dietary adherence among renal patients undergoing hemodialysis using the Food Frequency Questionnaire (FFQ). Conducted as a hospital based prospective study, it examines the consistency of food consumption over time and the impact of dietary counseling on adherence to prescribed renal dietary regimens. The study found that dietary noncompliance is often due to taste preferences and the complexity of dietary restrictions, particularly concerning high sodium foods. Despite these challenges, dietary counseling significantly improved energy and protein intake, aligning with dietary recommendations. The findings suggest that systematic and periodic dietary counseling can effectively enhance adherence, thereby improving patient outcomes and quality of life.*

**Keywords:** Hemodialysis, dietary adherence, renal patients, Food Frequency Questionnaire, nutritional counseling

## 1. Introduction

Renal patients undergoing hemodialysis face complex nutritional challenges due to the mechanisms underlying their treatment. Hemodialysis (HD), a life-sustaining procedure for patients with end-stage renal disease (ESRD), involves the removal of waste products and excess fluids from the blood when the kidneys can no longer perform these functions adequately. This process significantly alters the body's fluid and electrolyte balance, necessitating strict dietary control to prevent complications such as hyperkalemia, hyperphosphatemia, and fluid overload [1].

Dietary intervention is a cornerstone in the management of hemodialysis patients, aimed at mitigating these risks and improving overall health outcomes. However, non-adherence to dietary recommendations is a prevalent issue among these patients, often leading to adverse health effects and increased hospitalizations [2]. Factors contributing to non-adherence include the complexity of dietary restrictions, a lack of understanding about the dietary guidelines, and the burden of managing chronic illness [3].

Nutritional counseling has been shown to play a critical role in improving dietary adherence among hemodialysis patients. Studies have demonstrated that personalized nutritional counseling can significantly enhance patients' knowledge and motivation, leading to better adherence to dietary restrictions and improved clinical outcomes [4]. The use of tools such as the Food Frequency Questionnaire (FFQ) can further support these efforts by providing a structured method for patients to track their food intake, identify dietary patterns, and make necessary adjustments to align with their dietary goals.

This study is significant as it highlights the importance of dietary adherence in improving the health outcomes of renal patients on hemodialysis. The use of FFQ provides valuable

insights into the dietary patterns and the effectiveness of dietary counseling in managing dietary adherence, which is crucial for patient survival and quality of life.

The objective of this study was:

- To measure the constancy of foods consumed over period of time during the study period by renal subjects who were on regular HD regimen.
- To examine the effects of renal dietary adherence in the HD group.

## 2. Materials and Methods

A prospective study was conducted on ninety patients over a period of one year with three monthly follow ups on their dietary intake. The study samples were undergoing regular twice/thrice weekly hemodialysis sessions at St. John's Medical College Hospital, Bengaluru. A one-to-one interview method using validated questionnaire was used to collect information on their dietary pattern. Institutional Ethical Committee approval was obtained for the conduct of the study. The subjects were included and excluded based on the following criteria:

### Inclusion criteria

- Participants with CKD stage V on MHD of either gender with  $\geq 18$  years to  $\leq 65$  years of age.
- Those individuals who have undergone  $\geq 3$  months of hemodialysis and permanent dialysis access arteriovenous (A.V) Fistula/A.V Graft.
- Subjects who were voluntarily willing to participate in the research study.

### Exclusion criteria

- Those subjects suffering from severe cardiac and liver failure.
- Samples who were retroviral positive.
- Subjects diagnosed to have tuberculosis or malignancy.

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The information on respondents was obtained through patient chart reviews. A 24-hour dietary recall on three consecutive days was taken to assess the nutrient composition of the dietary intake along with daily fluid intake by food diary method. The three days included for the study were:

**Day 1:** Previous Day of Dialysis.

**Day 2:** On the day of Dialysis.

**Day 3:** Next day of Dialysis.

Nutrient intake was calculated using Ntuitive® app which has pre-existing data based on the Indian Food Composition Tables [5].

Food Frequency Questionnaire (FFQ) was used to understand the pattern and frequency of food items consumed categorized in all food groups on the basis of varied timelines as never, monthly, fortnightly, 3-4 times a week, twice a week, once a week and daily intake. FFQ was carried out at baseline visit, 6<sup>th</sup> monthly follow up visit and end of study visit and was framed in the manner for list of avoid and allowed food items in each food group as per the prescribed dietary regimen. The response pertaining to knowledge, attitude and behaviour of renal diet was also collected on the respondents' adherence to dietary pattern. Education intervention programme was conducted to the samples at all the 5 study visits – baseline visit (0 month), 3<sup>rd</sup> monthly follow up visit, 6<sup>th</sup> monthly follow up visit, 9<sup>th</sup> monthly follow up visit, end of study visit (12<sup>th</sup> month) to ensure patient compliance to diet and treatment regimen. The subjects were exposed to intervention program of education modules developed through lecture method, individual counselling, group (patient and care givers) counselling sessions, visual aids, interaction sessions, demonstrations and group discussions. Laboratory parametric values over 3 months was assessed during the complete study period. Descriptive and inferential statistics were utilized to analyse the data. Continuous variables were stated using Mean and standard deviation for the normally distributed variables. Categorical variables were mentioned using number and percentages. Repeated measures ANOVA was carried out to assess the time effect and interaction effect of outcome and this test was used to interpret hematochemical parameters and nutrient composition. Correlation coefficient was used to measure the strength of a linear association between two variables applicable on knowledge, attitude and practice of

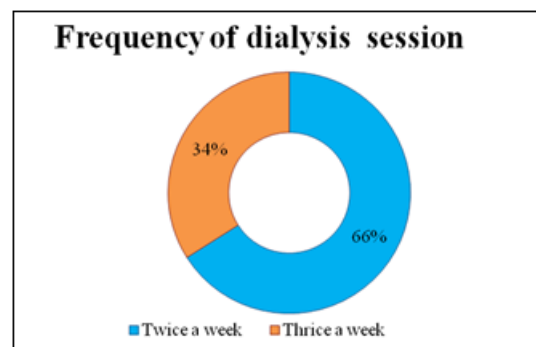
renal dietary regimen among the study population. FFQ was assessed using Cochran's Q test to determine the differences of various foods consumed over the time.

### 3. Result and Discussion

**Table 1: Demographics**

Characteristics	Category	Respondents	
		Number	Per cent
Age Group (years)	18 - 30 yrs	11	12
	31 - 45 yrs	17	19
	46 - 55 yrs	22	24
	56 - 65 yrs	40	45
Age (Mean±SD): 49.67±13.17years			
Gender	Male	61	68
	Female	29	32

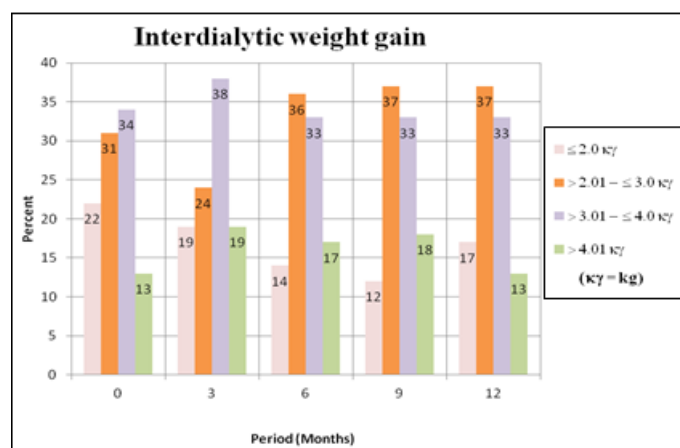
The metrics in Table 1 present the demographic profile of the respondents. Almost two-thirds (45 per cent) of the study participants were aged between 56 to 65 years and 68 per cent were male. The mean age was approximately 50 years.



**Figure 1:** Frequency of Dialysis Session

Figure 1 illustrates the frequency of dialysis schedule among the respondents. The respondents had been undergoing hemodialysis for one year with sixty six percent on a twice weekly dialysis regimen.

It was seen that patients on biweekly hemodialysis were more adherent to their diet as compared to patients with thrice weekly hemodialysis regimen. Our study was in par with similar results where a pilot study found that twice-weekly hemodialysis schedules had better patient-reported outcomes contributing to better dietary adherence [6].



**Figure 2:** Interdialytic Weight Gain (IDWG)

IDWG in the study group was between 3 to 4 kgs over a period of 3 months which was reduced to 2 to 3 kgs through dietary counseling over 12 months as shown in Figure 2.

Studies have shown that dietary counseling can significantly reduce IDWG in hemodialysis patients. One systematic review and meta-analysis found that educational and behavioural interventions were effective in reducing IDWG [7, 8]. This findings support the idea that dietary counseling is an effective strategy for managing IDWG in hemodialysis patients, improving their overall health outcomes and quality of life

**Table 2:** Haematochemical Measures

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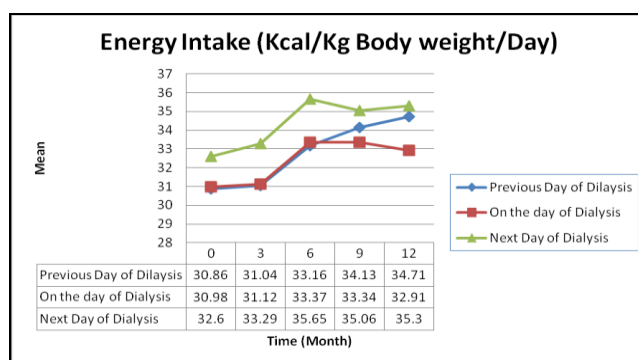
**Table 2:** Haematochemical Measures

Category	0 Month Mean (SD)	3 Month Mean (SD)	6 Month Mean (SD)	9 Month Mean (SD)	12 Month Mean (SD)	p value
Haemoglobin (g/dL)	009.25 (01.52)	009.04 (01.58)	009.16 (01.50)	009.29 (01.33)	009.44 (01.35)	0.171, NS
RBS (mg/dL)	153.88 (81.26)	149.33 (79.89)	154.24 (74.96)	149.18 (78.96)	147.01 (71.53)	0.784, NS
Glycated HbA1c (%)	007.46 (01.60)	007.28 (01.42)	007.35 (01.08)	006.99 (01.71)	007.04 (0.91)	0.222, NS
S.Creat (mg/dL)	009.03 (02.64)	009.13 (02.88)	009.22 (02.93)	008.97 (02.42)	008.65 (02.28)	0.113, NS
Calcium (mg/dL)	008.17 (00.77)	008.28 (00.65)	008.36 (00.57)	008.40 (00.64)	008.33 (00.64)	0.028, S
Phosphorus (mg/dL)	004.48 (01.31)	004.52 (01.44)	004.64 (01.41)	004.42 (01.31)	004.16 (01.26)	0.015, S
Total Protein (g/dL)	007.10 (00.70)	007.13 (00.66)	007.11 (00.62)	007.11 (00.64)	007.18 (00.56)	0.331, NS
Albumin (g/dL)	003.49 (00.44)	003.49 (00.35)	003.41 (00.34)	003.47 (00.32)	003.57 (00.38)	0.005, S
Alk. Phosphatase(U/L)	149.30 (84.00)	154.79 (76.56)	161.94 (99.33)	159.26 (94.48)	159.60 (90.65)	0.753, NS
Sodium (mEq/L)	135.75 (03.63)	135.56 (03.84)	135.58 (03.10)	136.05 (03.44)	135.72 (03.59)	0.801, NS
Potassium (mEq/L)	005.49 (00.71)	005.53 (00.74)	005.49 (00.69)	005.55 (00.60)	005.42 (00.64)	0.623, NS
Urea Reduction Ratio (%)	066.52 (09.30)	066.20 (08.48)	069.59 (08.64)	068.86 (08.51)	069.99 (08.06)	0.024, S

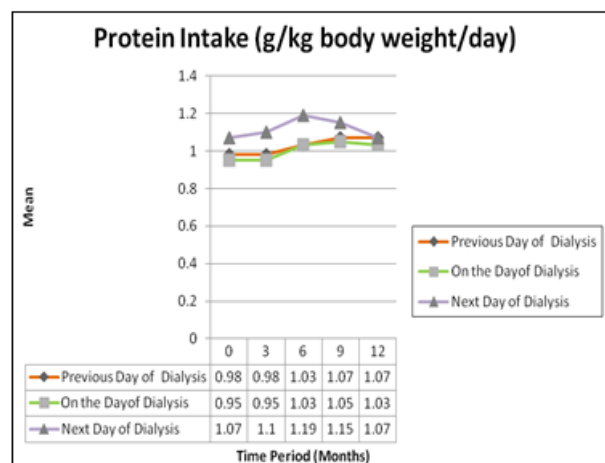
NS: Non-Significant and S: Significant

The table above outlines the haematochemical findings, indicating significant changes over time from baseline to the end of the study in key hematochemical parameters such as serum calcium, phosphorus, serum albumin, and URR—critical biochemical markers for the renal population. The URR, reflecting dialysis adequacy, showed a steady increase throughout the study. Serum albumin levels remained within the acceptable range for visceral protein stores, while serum calcium and phosphorus levels provided sufficient data to predict bone health. Although there was minimal variation in the mean levels of albumin, calcium, and phosphorus, their statistical significance demonstrated effective control of these essential indices. Other biochemical parameters showed no significant changes, with mean values remaining consistent throughout the study. All biochemical indices fell within the required reference ranges, indicating good nutritional status and adherence to the three pillars of therapy—diet, drugs, and dialysis—achieved through regular interaction with the researcher.

Similar and concurrent studies performed by Tayyem, R.F., et. al., 2008 [9] reported findings which were on par with the present study showing all biochemical parameters being in the normal range except for the serum albumin level which was low from the study conducted by Anjali, 2015[10]. The present study depicted majority of study samples to be in 3.5mg/dl as against 39% by a study conducted by Girija, 2015 [11].



**Figure 3(a):** Energy consumption among the respondents



**Figure 3(b):** Protein consumption among the respondents

The analysis of the three-day dietary records indicated that the mean intake of energy and protein, adjusted for body weight, showed a statistically significant increase over time and across different phases of the dialysis regimen. However, while the interaction between time period and dialysis phase was not statistically significant for energy intake [Figure 3 (a)], it was significant for protein intake [Figure 3 (b)]. The findings revealed a consistent rise in energy and protein consumption over time and during different dialysis phases. Despite smaller portion sizes, the meals were nutrient-dense, particularly in protein content, as reflected in the dietary intake. This improvement was achieved through recipe demonstrations and counseling, which were key educational tools employed in the study [12]. In another study, adherence to dietary guidelines among hemodialysis patients improved with consistent dietary counseling to meet their nutritional requirements reflecting an increase in both energy and protein intake over time [13].

Studies have shown varied results regarding the impact of dietary counseling on energy and protein intake in hemodialysis patients. A systematic review highlighted that interventions those involving dietitians can positively affect nutritional intake in hemodialysis patients indicating improvements in energy and protein intake when regular dietary counseling was provided over an extended period.

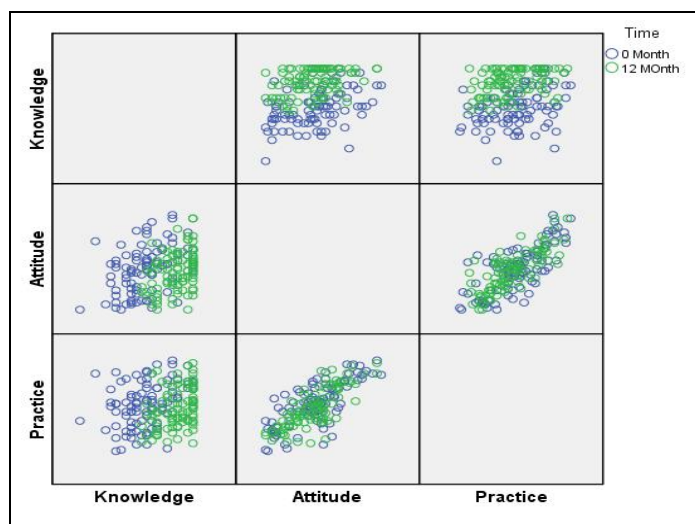
Table 3 focused on the food frequency patterns of the study population, specifically examining their consumption of various food items that were either recommended or restricted according to their treatment regimen. The findings revealed that participants regularly consumed normal salt foods, which were meant to be avoided or restricted, consistently throughout the study, leading to statistically significant increases in fluid intake and interdialytic weight gain (IDWG) (Figure 2). Fruits that were either allowed or

recommended to be avoided were consumed in nearly equal proportions over time, also with statistical significance. Additionally, the most non-compliant food items, such as fried foods, bakery products, processed foods, and ready-to-eat meals, were among the favorites of the study population, with significant statistical findings. The observed dietary non-compliance may be attributed to the taste preferences and the challenges posed by dietary restrictions.

Studies have shown that dietary counseling can significantly influence the dietary habits of hemodialysis patients with various interventions resulting in notable improvements and some limitations.

Food frequency assessment was performed by the following studies.

A cross-sectional study on 188 HD subjects to assess the overall compliance behavior to therapeutic regimens and the determining factor contributors for compliance, the results revealed that subjects with longer duration on HD were more non-compliant. The study postulated that though ESRD group was eager to change their dietary habits to meet the requirement of a newly received life-saving HD treatment, however in due course of time the subjects felt bored and got easily frustrated with the need to comply on long lists of dietary and fluid restrictions. Hence compliance to dietary and fluid restriction was found to be poor among the study group which was on par with the present study reflecting on non-adherence to diet and fluid status [14]. In concurrence to this, another study findings revealed that there was higher sodium fast foods and convenience foods consumption [15] with less perceived barriers on dietary adherence affecting the low sodium diet prescription [16]. Regular interactions with dietitians and tailored dietary plans appear crucial in achieving and maintaining the necessary dietary standards.



**Figure 4:** Correlation between Knowledge, Attitude and Practice on Adherence to Renal Dietary Regimen

Figure 4 analyzed the relationship between overall knowledge, attitude, and practice of the renal dietary regimen using correlation methods. A significant correlation was found between baseline and end-of-study knowledge perceptions with overall attitude and practice at both the start and end of the study, achieving a significance level of 0.01. The structured dietary education program positively

impacted attitude and practice over time, highlighting the importance of effective communication and interpersonal relationships established through regular interactions during the study.

Studies on the relationship between knowledge, attitude and practice of renal dietary regimen among hemodialysis

patients showed mixed results, indicating increase in dietary [17, 18].  
 knowledge can improve attitudes and practices related to diet

**Table 3: Consistency in Food Frequency**

Characteristics	Category	Respondents											
		Allowed						Avoid					
		0 Month		6 Month		12 Month		0 Month		6 Month		12 Month	
		N	%	N	%	N	%	N	%	N	%	N	%
Normal salt foods	Never							2	2.2	1	1.1	0	0
	Monthly							6	6.7	2	2.2	5	5.6
	Fortnightly							6	6.7	7	7.8	3	3.3
	3-4times a week	-	-	-	-	-	-	19	21.1	13	14.4	11	12.2
	Twice a week							15	16.7	10	11.1	9	10
	Once a week							0	0	1	1.1	2	2.2
	Daily							42	46.7	56	62.2	60	66.7
	<b>p value</b>	-						<0.001, S					
Fruits	Never	0	0	0	0	0	0	1	1.1	0	0	0	0
	Monthly	0	0	0	0	0	0	9	10	4	4.4	1	1.1
	Fortnightly	1	1.1	0	0	0	0	15	16.7	19	21.1	18	20
	3-4times a week	8	8.9	7	7.8	7	7.8	2	2.2	1	1.1	0	0
	Twice a week	57	63.3	69	76.7	75	83.3	12	13.3	18	20	12	13.3
	Once a week	21	23.3	11	12.2	6	6.7	46	51.1	45	50	56	62.2
	Daily	3	3.3	3	3.3	2	2.2	5	5.6	3	3.3	3	3.3
	<b>p value</b>	0.030, S						0.029, S					
Fried foods	Never							1	1.1	0	0	1	1.1
	Monthly							9	10	3	3.3	3	3.3
	Fortnightly							8	8.9	11	12.2	8	8.9
	3-4times a week							8	8.9	11	12.2	8	8.9
	Twice a week	-	-	-	-	-	-	1	1.1	0	0	0	0
	Once a week							9	10	9	10	8	8.9
	Daily							60	66.7	66	73.3	69	76.7
	<b>p value</b>	-						0.026, S					
Bakery products	Never							12	13.3	7	7.8	9	10
	Monthly							17	18.9	14	15.6	7	7.8
	Fortnightly							7	7.8	14	15.6	18	20
	3-4times a week							7	7.8	14	15.6	18	20
	Twice a week	-	-	-	-	-	-	2	2.2	4	4.4	2	2.2
	Once a week							14	15.6	13	14.4	18	20
	Daily							35	38.9	36	40	34	37.8
	<b>p value</b>	-						0.071, S					
Miscellaneous foods (Processed)	Never							2	2.2	1	1.1	1	1.1
	Monthly							1	1.1	0	0	0	0
	Fortnightly							3	3.3	1	1.1	1	1.1
	3-4times a week	-	-	-	-	-	-	4	4.4	2	2.2	2	2.2
	Twice a week							29	32.2	19	21.1	20	22.2
	Once a week							26	28.9	44	48.9	45	50
	Daily							25	27.8	23	25.6	21	23.3
	<b>p value</b>	-						0.017, S					
Other Ready to eat foods/ Eating out	Never							8	8.9	6	6.7	6	6.7
	Monthly							5	5.6	4	4.4	3	3.3
	Fortnightly							5	5.6	3	3.3	2	2.2
	3-4times a week	-	-	-	-	-	-	5	5.6	5	5.6	7	7.8
	Twice a week							41	45.6	31	34.4	30	33.3
	Once a week							22	24.4	37	41.1	38	42.2
	Daily							4	4.4	4	4.4	4	4.4
	<b>p value</b>	-						<0.001, S					

NS: Non-significant and S: Significant

#### 4. Conclusion

A well-organized and ongoing dietary counseling approach is essential for aiding patients in following their renal diet and fluid intake regimen. Consistently reinforcing dietary guidelines and educating patients about their importance can greatly decrease non-compliance and enhance overall health.

Regular follow-up meetings help patients get engaged and motivated, which is crucial for maintaining adherence to dietary restrictions over the long term. Integrating renal recipes into treatment regimens can effectively align dietary needs with personal preferences, enhancing patient adherence. Traditional cuisine generally holds cultural significance, which can affirm a patient's commitment to

their dietary plan. This congruence not only supports dietary adherence but also contributes to an improved quality of life by making the treatment plan more enjoyable and sustainable.

**Conflict of Interest:** The authors declare no conflict of interest

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