

ORIGINAL ARTICLE

The Evaluation of Adherence to Dietary and Liquid Intake Recommendations in Hemodialysis Patients

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ABSTRACT

Background: Non-adherence of hemodialysis patients to their recommended diet, and limitations on fluid intake, leads to the production of toxic substances and metabolites in the bloodstream, which can increase the risk of mortality in these patients. This study evaluated the adherence to dietary and liquid intake recommendations in hemodialysis patients.

Methods: One hundred and four hemodialysis patients were evaluated for dietary intake and adherence to dietary recommendations. Their dietary practice was evaluated using a 95-item food frequency questionnaire, and the Dialysis Diet and Fluid Nonadherence Questionnaire (DDFQ) questionnaire was used to assess non-adherence to dietary and fluid intake recommendations. The amount of weight gain between two sessions of dialysis and biochemical parameters of the patients was also measured. Statistical analysis was performed using SPSS version 22.

Results: Approximately 21.8% and 34.7% of patients did not adhere to their diet and of fluid intake recommendations. The rate of non-adherence to fluid intake recommendations were higher than the dietary recommendations. Protein intake of the patients was at an expected level, but their potassium intake was higher than the requirement of these patients.

Conclusion: The number of days of non-adherence to the diet was less than that of the fluid intake recommendations. Also, the degree of non-adherence were more severe for dietary recommendations, compared to fluid intake limitations.

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Introduction

Chronic kidney disease (CKD) is a common health problem, and its control requires supportive treatment with different methods of dialysis (1, 2). The end stage renal disease is a limiting and chronic condition that has negative effects on the patients life. Dialysis affects physical activity, life expectancy, sexual function, and occupational

activity, and can change the quality of life of these patients (2). Changing the quality of life of these patients is such that it causes depression, and sometimes leads to suicide and premature death (3). In addition, Although these patients tolerate limitations on their diet, fluid intake and medicine, and pay a high cost for receiving health care, they do not have a long life span (4).

The number of people with this disease is increasing due to an increase in diabetes, hypertension and malignant diseases (5). The prevalence of chronic kidney failure in the world is 242 cases per million, and about 8% is added annually to the number of these patients (6). According to a study in 2009, the prevalence of chronic kidney disease in stages 3-5 was reported to be 14.9% (7). The number of patients undergoing hemodialysis annually increases by about 15% (8), and 1200-1600 patients are diagnosed with this chronic kidney disease, annually (9).

Adherence to the diet and limitation of fluid intake is an important factor for dialysis patients, which is essential for their survival and well-being. Adherence to the diet and fluid intake recommendations is one of the most important health issues that maintains recovery, reduces the cost of treatment, decreases the risk of complications and improves the quality of life of the patients. Non-adherence with the diet and fluid limitations is associated with increased water retention and phosphorus in the blood, resulting in increased inability and mortality in these patients. Non-adherence with the diet also increases the costs for the patient and the health system of community (10, 11).

The diet for hemodialysis patient's should be planned so that the weight gain at dialysis intervals be less than 4% of the body weight. Patients who are hemodialyzed three times a week should consume 1.2 grams of protein per kilogram body weight daily, and at least 50% of that must have high biological value. In dialysis patients, the kidney is not able to secrete all of the consumed potassium, therefore, these patients should restrict their potassium intake. In these patients, serum potassium levels should be repeatedly measured (12).

Also, in these patients, plasma phosphorus is increased and the level of calcium in the plasma decreases, thus it is recommended to reduce the consumption of phosphorus and increase the calcium intake. The sodium intake in the diet of hemodialysis patients should be limited to 2-3 grams per day. In addition, the risk of cardiovascular disease increases in these patients. These patients should also limit their daily fluid intake and receive an average of 750 to 1000 milliliters per day in addition to the amount of their urine output (12).

Studies have shown that various factors such as age, sex, dialysis adequacy, duration of dialysis, awareness about the illness and its treatment, smoking, social support, and awareness of the specific guidelines for dialysis patients are associated with non-adherence with the diet and fluids in these patients (13). Considering the increasing number of patients undergoing hemodialysis and the role of

nutrition in maintaining the status of homeostasis in the patient's body and improving the quality of life and increasing the patients' longevity, the present study was conducted to evaluate the adherence to dietary and liquid intake recommendations in hemodialysis patients.

Materials and Methods

This study is a descriptive-cross-sectional study. The patients recruited in this study were selected from patients undergoing hemodialysis in the Faghihi Hospital of Shiraz, Iran and Sadra Central Dialysis Center, Sadra Town, Iran. The sample size was calculated on the basis of study by Ahrari et al. (14), and by taking into account the probability of a type 1 error of 0.05 and a power of 80%, and the correlation coefficient of 0.27 between serum potassium and the degree of non-adherence to the limitations of fluid intake, 104 participants were selected.

The inclusion criteria in the study was age between 18 and 65 years, lack of cognitive impairment, at least having reading and writing skills, residence in Shiraz, willingness to participate in the study, lack of inflammation and severe physical problems, the kidney disease of the final stage, who is consistently under the hemodialysis, and was dialyzed every two to three times a week, and at least 6 months has passed from the start of their dialysis treatment. The exclusion criteria included inflammatory diseases, and other diseases that required dietary changes.

After finding eligible patients for the study, the purpose of the study was first explained to patients, and if the patient was willing to participate in the study, written consent form was signed by the patients. Anthropometric indices were measured as follows: The body weight of the participants after dialysis was measured at the lowest level of clothing and the accuracy of 0.1 kg using the Seca scale, model: 713. The height of the patient was measured using a tape meter, without shoes. Body mass index (BMI) was calculated dividing the weight (kg) by the square of height (square meter). In order to calculate the weight gain between dialysis sessions, the weight of the patient before the dialysis was measured as well. To increase the accuracy of the work, we checked the weight gain between dialysis sessions three times during dialysis sessions, and the reported number is the average weight gain between three sessions of dialysis.

Levels of potassium, phosphorus and albumin, fasting blood glucose, total cholesterol, triglyceride, creatinine, blood urea, calcium, phosphorus, albumin, iron, sodium, potassium, alkaline phosphatase, ferritin, total iron binding capacity, parathyroid hormone, alanine transamines and

aspartate transaminase levels were extracted from the patient's laboratory records. During the period when the patient was undergoing dialysis, a demographic questionnaire was completed for each patient. In order to assess the patients' dietary food intake, the food frequency questionnaire (95 items) was completed by the researcher and analyzed by Nutritionist 4 software (15). The validity and reliability of this food frequency questionnaire (95 items) have been investigated by Ali Asghari et al. (16).

In order to determine the extent of non-adherence with dietary recommendations and limitation of fluid intake, the DDFQ questionnaire (Dialysis Diet and Fluid Non-adherence Questionnaire) was completed. The questionnaire was completed through interviewing by the researcher. The DDFQ questionnaire contains 4 questions. Two questions are related to non-adherence with the diet (severity and frequency) and the 2 other questions are related to non-adherence with the limitations of fluid intake (severity and frequency). The frequency of non-adherence was evaluated for 2 consecutive weeks and was asked on the number of non-compliance days in the past 14 days.

The degree and severity of deviation from recommendations were evaluated using a Likert scale of 5 points. In the sense that the zero score means non-deviation from the limitations (full adherence to the limitations) and point 4 indicates non-adherence to the diet. This questionnaire has been validated by Ahrari et al. (11) in Iran. The questions of this questionnaire are shown in Figure 1.

Statistical analysis were performed using SPSS software (version 22, Chicago, IL, USA). The

Pearson correlation test was used to examine the relationship between variables. Also, the Chi-square test was used to examine the relationship between qualitative variables. A P-value less than 0.05 was considered statistically significant.

Results

Of the 104 patients who referred to the Shahid Faghih Hospital and the Sadra Dialysis Center, 59 of them were men (58.4% of the participants) and 42 of them were women (39.6%). The mean age of the participants was 49.9 ± 15.40 years. The participants were from the different occupational groups and with different levels of education (Table 1). About 67.3% of the participants had hypertension and 26.7% a rise in blood lipids. Basic and laboratory information is illustrated in Table 2. The patients' weight gain between two consecutive sessions of dialysis was in the range of 0.4 kg with the mean of 1.08 ± 1.16 Kg.

The average number of days of non-adherence of individuals to the diet and fluid intake was (5.72 ± 5.72) and (7.33 ± 6.33) days, respectively. The severity of non-adherence of patients with diet and fluid restrictions was shown in Figure 2. Respectively, 33% and 29% of the dialysis patients adhered to their specific diet and restricted fluids intakes. As can be seen, the degree of non-adherence to the recommendations for limitation on fluid intake was more severe than dietary recommendations. The results of the analysis of the food frequency questionnaire were shown in Table 4. The portion of carbohydrate, protein and fat in daily calorie supply was 70%, 9% and 25%, respectively.

1.1. How many days during the past 14 days didn't you follow your diet guidelines?
1.2. To what degree did you deviate from your diet guidelines?
No deviation Mild Moderate Severe Very Severe
0 _____ 1 _____ 2 _____ 3 _____ 4
2.1. How many days during the past 14 days didn't you follow your fluid guidelines?
2.2. To what degree did you deviate from your fluid guidelines?
No deviation Mild Moderate Severe Very Severe
0 _____ 1 _____ 2 _____ 3 _____ 4

Figure 1: The dialysis diet and fluid, non-adherence questionnaire (DDFQ) used in the study (11).

Table 1: Patients' demographic information.

Variable	Percentage	
Occupation	Housewife	39.4
	Employee	6.4
	Self employment	17.0
	Jobless	20.2
	Retired	17.0
Education	Illiterate	11.7
	Elementary	30.9
	Guidance school	16.0
	High school	26.6
	College degree	2.1
	Bachelor degree	11.7
Gender	Male	58.4
	Female	39.6

Discussion

The results of the present study showed that the number of days of non-adherence to the diet was less than the days of non-adherence to the limitation on intake of liquids. Also, the degree of non-adherence were more severe for dietary recommendations, compared to fluid intake limitations, so that severe and very severe non-adherence to fluid intake was found to be much higher than the diet. Kuglar et al. (2005) (17) and Kara et al. (2007) (18) reported that hemodialysis patients have a poor adherence to their dietary habits and limitations of fluid intake. Failure to adhere to the limitations of fluid intake is one of the most stressful aspects of the treatment of hemodialysis patients. A study by Kuglar and

Table 2: Basic and laboratory information of participating patients.

Variable	Mean±SD
Age (years)	49.92±15.40
Weight (kg)	63.93±20.35
Height (cm)	164.07±11.07
BMI (kg/m ²)	22.84±4.49
Waist (cm)	95.85±12.11
WHR	98.57±10.67
FBS (mg/dl)	0.9683±0.0498
Total cholesterol (mg/dl)	115.89±63.79
TG (mg/dl)	134.25±35.51
BUN (mg/dl)	108.08±63.76
Cr (mg/dl)	55.11±16.40
Ca (mg/dl)	7.57±2.73
P (mg/dl)	9.53±5.43
Albumin(mg/dl)	7.00±12.21
Fe (mg/dl)	3.89±0.5161
Na (mg/dl)	121.36±169.31
K (mg/dl)	139.50±3.67
ALK (mg/dl)	5.42±1.07
AST (mg/dl)	549.95±413.10
ALT (mg/dl)	17.32±8.67
PTH (mg/dl)	18.83±14.57
Iron TIBC (mg/dl)	388.19±348.44
Feritin (mg/dl)	265.70±79.33
	487.52±535.25

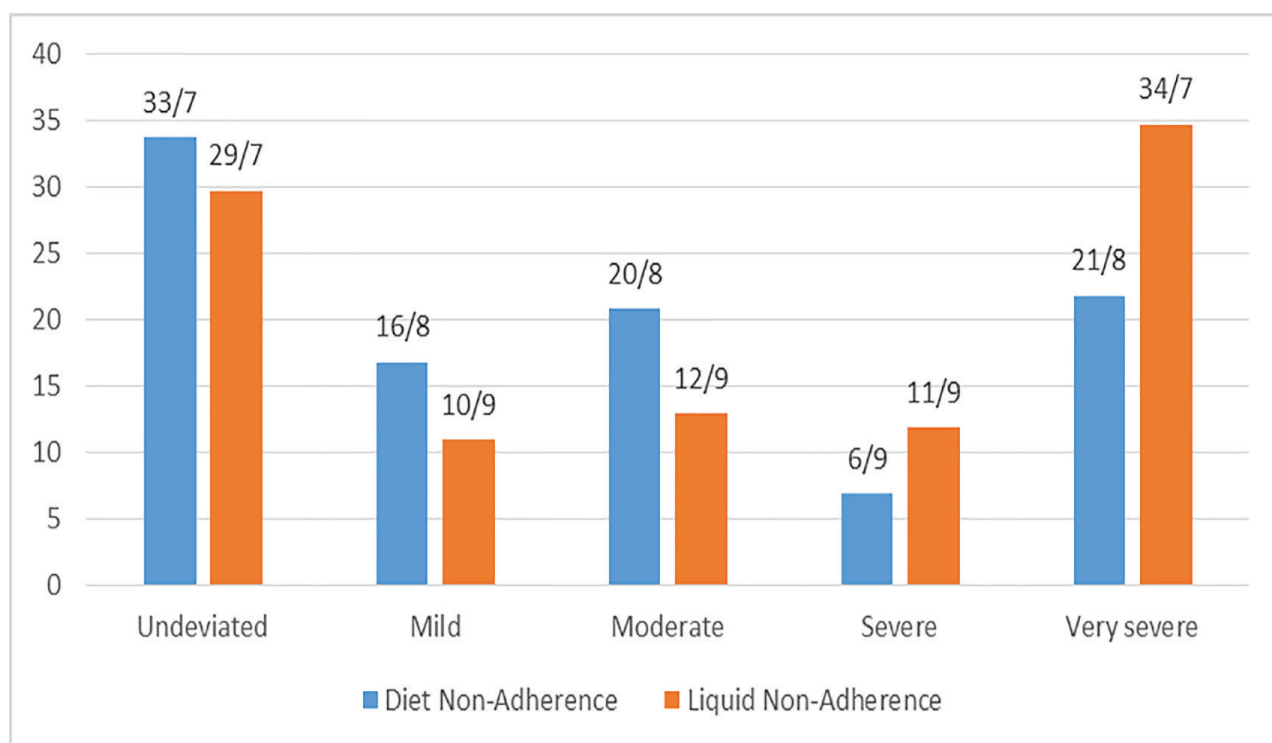
**Figure 2:** The degree of fluids and diet non-adherence in hemodialysis patients.

Table 3: The dietary intake of patients.

Variable	Mean±SD
Energy (Kcal)	2641±8163.10
Carbohydrate (gram)	464.32±1849.36
Protein (gram)	61.72±131.86
Fat (gram)	74.64±194.89
Sodium (mg)	3717.49±4557.82
Iron (mg)	19.24±74.33
Magnesium (mg)	365.51±1425.56
Zinc (mg)	8.14±21.80
Vitamin A (µgr)	1969.98±9383.32
Vitamin E (mg)	7.63±26.08
Folate (mg)	425.91±1634.65
Vitamin C (mg)	494.46±3135.46
Vitamin K (µgr)	221.49±851.05
Soluble fiber (gram)	1.79±10.48
Crude fiber (gram)	13.91±77.18
Cholesterol (mg)	212.33±414.62
Potassium (mg)	5888.75±31240.64
Calcium (mg)	840.23±2468.82
Phosphor (mg)	1159.06±3736.70
Vitamin D (µgr)	0.88±2.60
Dirtary fiber (gram)	34.01±179.91

colleagues indicated that in the United States and Germany, the percentage of patients who did not follow their diets were 22% and 26%, respectively, and this percentage for non-adherence to fluid restriction was 19.5% and 20.7%, respectively. Studies on German patients showed that older patients use home-made foods more while, younger ones due to lifestyle changes, are more likely to use ready-to-eat foods that usually have more phosphorous. It has also been found in these studies that the level of education of individuals had an influence on the patients' adherence to their diet and their fluid itake limitations.

Adherence to the diet and limitation of fluid intake is an important and vital factor for dialysis patients, which is essential for their survival and well-being. In the present study, the average number of days of non- adherence to the diet was 5.5 days and the number of days of non- adherence to the limitations of their fluid intake was 7.2 days. While in the study of Ahrari and his colleagues in Gonabad, Iran in 2013, the adherence of 237 hemodialysis patients to diet and fluid intake was measured using the DDFQ questionnaire. The results of their study showed that 41.1% and 45.2% of patients, respectively, did not follow the dietary and fluid recommendations, and the average number f days of non- adherence was 5.24 days for the diet and 8.04 for liquids (14).

The results of the present study showed that 33.7 percent of patients completely adhere to their specific diet and 21.8 percent of people do not adhere to their diet at all, while these percentages were

respectively 13.7% and 9.6% in a study by Ahrari et al. Different from our study, in their study, patients had a moderate or mild degree of non-adherence to thire diet. As we observed in this study, a higher percentage of patients adhered to their diet which can be indicative of the fact that in hospitals and dialysis centers of Shiraz, the patients' nutritional knowledge of their diet is high.

In our study, 34.7% of the patients did not adhere to their limitations on fluid intake. According to the DDFQ questionnaire, patients who obtained the score of 5 (very severe group) from this questionnaire had the highest number of participants. On the contrary to our study, Ahrari and colleagues stated that the highest number of patients with non-adherence to fluid restrictions were from the moderate non-adherence. One of the reasons for non-adherence to the fluid restrictions maybe the fact that Iranians have the habit of drinking tea several times during a day. In a cross-sectional study conducted by Cogler et al. In 2010, adherence to the diet and fluid restrictions was evaluated using the DDFQ questionnaire, and their results showed that 80.4% of patients did not adhete to their diet and 75.3% of them did not adhere to the limitation of fluid intake. In the non-adherent groups, phosphorus and serum albumin were higher than those who adhered to their diet (17). Another study was done by Cara et al. (2006) in Turkey. The results showed an increased non- adherence of the diet was associated with an increase in serum phosphorus, albumin and potassium and an increase in water retention in these patients (18).

The mean intakes of protein, fat, carbohydrate, potassium and phosphorus (mg) in hemodialysis patients in the current study was 61.7 (g), 74.6 (g), 464.3 (g), 5.888(mg), 1.159 (mg) per day, respectively. The average energy consumption among hemodialysis patients was 2641 kcal/day. However, in a study conducted in 2002 by Kalantarzadeh and his colleagues, hemodialysis patients received an average of 1604 kilocalories of energy, 53.7 g of protein, 63.9 g of fat, 203 g of carbohydrate, 2024 mg of potassium and 903 mg of phosphorus per day. In our study, compared to the study by Kalantzadeh et al. (19), the amount of potassium intake is higher than expected, which could be related to the level of consciousness of patients from the restriction of food intake, especially potassium-rich foods, so that our participants had less knowledge of their particular diet.

In another study by Panzetta et al., it was concluded that the ideal amount of energy consumption in hemodialysis patients (20) was 35 kcal/kg/day and the consumption of 1 to 1.2 g/kg of protein per day was ideal for the hemodialysis population. So that, the carbohydrates should be 45%

to 50% and fats should contain 35% to 40% of the total consumed energy. Compared to the panzatta study, in our study, the calorie intake of the patients were equal to or even more than recommendations, while the protein level was less than expected. Nutrition can be affected by socioeconomic factors. Moderate and poor economic conditions may lead to patients' inability to supply the required protein. Therefore, lower levels of protein intake can be attributed to this issue. In examining the contribution of each macro-nutrient in supplying calories, the consumption of carbohydrates was too high and the lipid was less than 35%. This imbalance in dietary regimens should be corrected in the future, because the excessive accumulation of carbohydrates can lead to an undesirable accumulation of fat in future.

Serum levels of potassium, phosphate and blood urea nitrogen indicate the patient's adherence to the diet and medication. While weight gain between two sessions of dialysis is indicative of the patient's adherence to the fluid recommendations. In this study, most of the patients had normal range of serum potassium and phosphate levels. This suggests that most patients adhere to the limitations of low-phosphate and potassium diets. The negative effects of disturbances in clinical markers with decreasing life expectancy and mortality in patients have been reported by various researchers. Researchers believe that the lack of patient involvement in hemodialysis sessions, and weight gain between two sessions of dialysis more than 5.7 percent of the dry weight would be dangerous, and would increase mortality in the patients. The results of this study showed that 34.7% of patients did not adhere to the limitations of the fluid intake.

The support of friends, community, nurses and other health care staff should be done to enhance communication with hemodialysis patients and their assistance should encourage patients to adhere to their diet. In addition, efforts should be made to provide more effective support for hemodialysis patients. Perhaps teaching the family of patients is one of the ways to provide this support. By increasing the awareness of dialysis patients about their diet and limitations on their fluid intake, patients can be helped to receive adequate fluid during dialysis sessions and prevent excess weight gain between sessions. Also, by informing patients of their particular diet, they can be helped to keep their blood biochemical data in the normal range. As a drawback to our study was small sample size. We could see better correlations if we have larger sample size. A strength of the present study was to complete the Food frequency questionnaire, because the questionnaire estimates food intake very accurately.

Conclusion

The results of the current study showed that the number of days of non-adherence to the diet was less than the days of non-adherence to the limitations of fluid intake. Also, the degree of non-adherence to the recommendations on the limitations of their fluid intake was more severe than their dietary recommendations, so that severe and very severe non-adherence to fluids was found to be much higher than the diet.

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Conflict of Interest

None declared.

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