Available online: https://journal.ipb.ac.id/index.php/jgizipangan ***J. Gizi Pangan, September 2025, 20(Supp.1):9-18***
Accredited based on DGHE, Republic of Indonesia 79/E/KPT/2023
ISSN 1978-1059 EISSN 2407-0920

Factors Associated with Adherence to Renal Diet among Dialysis Patients in Private Dialysis Center: A Cross-Sectional Study

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ABSTRACT

This study is aimed to assess the adherence status of renal diet, determine the association between sociodemographic characteristics, dietary knowledge, nutrition literacy, and perception of recommended diet and fluid, while also identifying significant factors that play a role in influencing adherence to the renal diet within this specific healthcare setting. This cross-sectional study with purposive sampling recruited 71 Chronic Kidney Disease (CKD) patients attending private dialysis centers in Selangor. Information on sociodemographic data, the End Stage Renal Disease Adherence Questionnaire (ESRD-AQ), the Dialysis-Related Dietary Knowledge Questionnaire (DDKQ), and the Dialysis Specific Nutrition Literacy Scale (DSNLS) were collected. The findings revealed that renal diet adherence of the respondent was 50.7%. The number of comorbidities, perception of recommended diet, and difficulty in watching diet recommendations were associated with adherence to renal diet among the participants. Further analysis using multivariate logistic regression revealed that the number of comorbidities (Adjusted Odds Ratio (AOR)=9.22, 95% Confidence Interval (CI): 2.10-40.47) and the difficulty in watching diet recommendations (AOR=0.04, 95% CI: 0.003-0.13) were significant determinants of dietary adherence. Dialysis patients with a higher number of comorbidities have a stronger likelihood of dietary adherence, meanwhile those with difficulty in watching diet recommendations have a higher tendency to non-adherence to renal diet. Thus, the difficulty identified should be overcome to improve renal diet adherence in the future.

Keywords: adherence status, chronic kidney disease, dialysis, renal diet

INTRODUCTION

Chronic Kidney Disease (CKD), which is categorized as an abnormality or progressive decline in kidney function, is a life-threatening illness that can certainly impair the patient's survival rate. Particularly those with ESRD and CKD are at a higher risk of mortality, mainly from cardiovascular diseases (Vaidya & Aeddula 2022). According to Kovesdy (2022), from 1990 to 2017, there was a 41.5% increase in the worldwide all-age death rate related to chronic kidney disease, ranking it as the 12th leading cause of death. Similarly, the prevalence of CKD in Malaysia was reported to increase from 9.07% in 2011 to 15.48% in 2018 and thus CKD has emerged as one of the main public health concerns (Thamil *et al.* 2020). Non-pharmacological approaches, such as dietary and lifestyle modifications, can assist in maintaining kidney function (Kalantar-Zadeh *et al.* 2021). Renal diets can be used as non-pharmacological treatments since they involve dietary management that is highly beneficial for CKD patients. The main objectives of dietary management with renal diets include maintaining renal function while minimizing problems and delivering adequate nourishment (Hershey 2018). Hence, poor renal diet compliance accelerates CKD progression and complications.

Globally the prevalence of non-adherence to dietary and fluid restrictions from the latest study through systematic review and meta-analysis is predicted 60.2% to 60.6% (Vijay *et al.* 2021). Non-adherence to dietary observed that is

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(Received 18-02-2025; Revised 26-05-2025; Accepted 21-08-2025; Published 15-09-2025)

much higher as compared to adherence in several studies. As evidence, a study done in Malaysia by Lim *et al.* (2020), the rate of dietary adherence was 34.9%. Furthermore, a study conducted by Opiyo *et al.* (2019) in Kenya has shown that 36.3% and 58.9% adhere to dietary prescription and fluid limitation respectively. The authors reported that more than half of adult patients struggle with adherence resulting in failing to follow their prescribed diet. Many major issues connected to kidney failure are brought on by the patient's ignorance of their nutritional needs and poor adherence to the information because of a negative attitude about maintaining a modified lifestyle (Kanagarajah *et al.* 2022). In view of the increased rate of non-adherence to the renal diet and its impact on health-related quality of life, there is a need to determine the factors associated with adherence to the renal diet in Selangor.

METHODS

Design, location, and time

In this study, cross-sectional study with a quantitative approach was chosen as the research strategy. The study was carried out from May until July 2023 among dialysis patients in five private dialysis centers in Selangor area that were notably chosen at Rawang, Klang, and Kapar.

This study has obtained ethical approval from Universiti Teknologi MARA Research Ethics Committee (FERC/FSK/MR/2023/00067). Consent forms also have been obtained from participants prior to their participation. All data were kept anonymous and confidential.

Sampling

The participants were chosen using the convenience sampling technique, in which the sample was specifically selected among dialysis patients in a designated area based on the inclusion and exclusion criteria. The sample size of 60 participants calculated was obtained from the recommendation of Viechtbauer *et al.* (2015). This study included hemodialysis patients with Malaysia citizenship, who were mentally and physically in good health and proficient in either English or Malay and excluded patients with a history of kidney transplantation.

The dependent variable in this study is the dietary adherence status of the renal diet. It was assessed using information gathered from the End Stage Renal Disease Adherence Questionnaire (ESRD-AQ). Next, the independent variables were possible factors that might influence adherence to the renal diet, consisting of sociodemographic characteristics, perceptions of the diet and fluid recommendations which also include motivation and difficulty, dietary knowledge, and nutrition literacy.

Data collection

A structured questionnaire was used in this study with a face-to-face distribution to the participants. The participant self-administered the questionnaire; however, assistance was offered if any difficulties were encountered. Following the approval of the ethical proposal, the study started in March 2023 and ended in July 2023. The structured questionnaire has been separated into four sections: sociodemographic section, ESRD-AQ, Dialysis-Related Dietary Knowledge Questionnaire (DDKQ), and Dialysis Specific Nutrition Literacy Scale (DSNLS).

End-Stage Renal Disease Adherence Questionnaire (ERSD-AQ). The second section of the study draws from previous research on the ESRD questionnaire (Kim *et al.* 2010), originally comprising four distinct subscales: general information (5 items), hemodialysis treatment (14 items), medications (9 items), and fluid restrictions (10 items), along with diet recommendations (8 items). Kim *et al.* (2010) established strong content validity (above 0.86) and good reliability (ICCs≥0.83) across all four subscales. For this current study, focus was placed on the fluid restriction and diet recommendation subscales, encompassing 18 questions to evaluate patient behavior, attitudes, and perceptions. Adherence behavior concerning both diet and fluid can be ascertained through questions 8 and 26, while questions 4, 5, 6, 12, 13, and 14 serve to assess attitudes and perceptions related to diet and fluid recommendations.

Dialysis-Related Dietary Knowledge Questionnaire (DDKQ). A 25-item Dialysis-Related Dietary Knowledge Questionnaire (DDKQ) latest version was obtained from Lim *et al.* (2020) which was successfully modified by Durose *et al.* (2004). It consists of multiple-choice questions generally related to potassium, sodium, and phosphate, and the participants had to choose the best answer based on their knowledge. Each correctly answered question received a "1" score,

while the wrong response and "not sure" responses received a "0" score. The overall knowledge scores were added together, and the result was given as a percentage of the total scores. In this research, 50% score and above were classified as having higher dietary knowledge while below 50% were classified as having lower dietary knowledge. This scale demonstrated significant content validity (S-CVI/Average=0.972), internal consistency (α=0.766), inter-rater reliability (mean weighted kappa=0.867), and test-retest reliability (ICC=0.944) (Lim *et al.* 2020).

Dialysis Specific Nutrition Literacy Scale (DSNLS). The European Health Literacy Questionnaire (HLS-EU-Q), which has been verified across six Asian countries, including Malaysia, established the basis for the development of the DSNLS (Lim *et al.* 2020). Six renal healthcare professionals including nephrologists, dietitians, dialysis nurses, and dialysis technicians participated in the content validation of the DSNLS, and the results showed that the content validity proved good (S-CVI/Average=0.96), (Polit *et al.* 2006 as cited in Lim *et al.* 2020). This section consists of 8 questions that require the participants to scale their literacy and understanding into; 1 (poor ability); 2 (fair ability); and 3 (good ability). Then, using the formula of the index, the mean subtracted to one and multiply by 50, the mean nutrition literacy scores were converted into continuous indices, ranging from 0 to 100, with a higher index representing greater nutrition literacy (Lim *et al.* 2020). The score was classified into two categories including higher nutrition literacy for 50% score and above as well as lower nutrition literacy for a score below 50%.

Data analysis

Descriptive statistics, including frequencies and percentages, were used to assess dietary and fluid adherence. Responses from the ESRD-AQ, collected using a 5-point Likert scale, were recoded into binary variables: “adherence” (coded as 1) for those who reported following recommendations all the time, and “non-adherence” (coded as 0) for all other responses. Both dietary and fluid adherence were treated as dichotomous variables.

To examine associations between renal diet adherence and factors such as sociodemographic characteristics, perceptions of dietary/fluid recommendations, dietary knowledge, and nutrition literacy, chi-square tests were performed. Binary logistic regression was then conducted to identify significant predictors of renal diet adherence, with Adjusted Odds Ratios (AOR) and p-values reported for each independent variable.

RESULTS AND DISCUSSION

A total of 71 participants from various private dialysis centers in Selangor successfully completed the research questionnaire as presented in Table 1 below. Dietary adherence status was reported as adherence with 50.7% (n=36) compared to non-adherence with 49.3% (n=35). The adherence status in this study is higher than the other research as reported by Opiyo *et al.* (2019) in Kenya and Lambert *et al.* (2017) where the adherence status was only 36.3% and 31.5% respectively. In contrast, the respondent's fluid adherence was higher in the non-adherence group (54.9%; n=39) than in the adherence group (45.2%; n=32). The same result pattern was observed in a study conducted in Palestine by Naalweh *et al.* (2017) for fluid restriction adherence where the adherence (31%) was lower than the non-adherence status (69%).

As shown in the Table 2, majority of respondents in this study were male (54.9%), Malay (56.3%), and married (87.3%). Most had more than six years of education (83.1%), were unemployed (67.6%), had a household income of RM4,850 or below (87.3%), lived in households with less than or equal to six members (81.7%), spent over RM500 on food monthly (57.7%), and had more than one comorbidity (60.6%). Sociodemographic

Table 1. Patient’s adherence status of diet and fluid

Variables (n=71)	n (%)
Dietary Adherence Status	
Adherence	36 (50.7)
Non-adherence	35 (49.3)
Fluid Adherence Status	
Adherence	32 (45.1)
Non-adherence	39 (54.9)

Table 2. Association of independent variable and dietary adherence status

Variables	Dietary adherence status		Total sample n=71	*p*
	Adherence n=36 (50.7%)	Non-adherence n=35 (49.3%)		
	n (%)	n (%)	n (%)	
Gender				0.072
Male	16 (41.0)	23 (59.0)	39 (54.9)	
Female	20 (62.5)	12 (37.5)	32 (45.1)	
Ethnicity				0.275
Malay	18 (45.0)	22 (55.0)	40 (56.3)	
Non-Malay	18 (58.1)	13 (42.9)	31 (43.7)	
Marital status				0.307*
Unmarried	3 (33.3)	6 (66.7)	9 (12.7)	
Married	33 (53.2)	29 (46.8)	62 (87.3)	
Years of education				0.065
<6 years	9 (75.0)	3 (25.0)	12 (16.9)	
≥6 years	27 (45.8)	32 (54.2)	59 (83.1)	
Employment status				0.177
Employed	9 (39.1)	14 (60.9)	23 (32.4)	
Unemployed	27 (56.3)	21 (43.8)	48 (67.6)	
Household income				1.000*
<RM4,850	31 (50.0)	31 (50.0)	62 (87.3)	
≥RM4,850	5 (55.6)	4 (44.4)	9 (12.7)	
Household size				0.387
≤6 people	28 (48.3)	30 (51.7)	58 (81.7)	
>6 people	8 (61.5)	5 (38.5)	13 (18.3)	
The number of households income recipient				0.282
≤1 person	25 (55.6)	20 (44.4)	45 (63.4)	
>1 person	11 (42.3)	15 (57.7)	26 (36.6)	
Household food expenditure				0.705
<RM500	16 (53.3)	14 (46.7)	30 (42.3)	
≥RM500	20 (48.8)	21 (51.2)	41 (57.7)	
Number of comorbidities				**0.003**
One and below	8 (28.6)	20 (71.4)	28 (39.4)	
More than one	28 (65.1)	15 (34.9)	43 (60.6)	
Perception on recommended diet				**0.014***
Important	35 (56.5)	27 (43.5)	62 (87.3)	
Less important	1 (11.1)	8 (88.9)	9 (12.7)	
Perception on fluid restriction				0.107*
Important	45 (53.8)	30 (46.2)	65 (91.5)	
Less important	1 (16.7)	5 (83.3)	6 (8.5)	

Continue from Table 2

Variables	Dietary adherence status		Total sample n=71	*p*
	Adherence n=36 (50.7%)	Non-adherence n=35 (49.3%)		
	n (%)	n (%)	n (%)	
Motivation for following recommended diet				1.000*
Perceive health benefit	32 (50.8)	31 (49.2)	63 (88.7)	
Other reasons	4 (50.0)	4 (50.0)	8 (11.3)	
Motivation for restricting fluid intake				1.000*
Perceive health benefit	29 (50.9)	28 (49.1)	57 (80.3)	
Other reasons	7 (50.0)	7 (50.0)	14 (19.7)	
Difficulty in watching diet recommendations				**<0.001**
Yes	4 (15.6)	27 (84.4)	32 (45.1)	
No	31 (79.5)	8 (20.5)	39 (54.9)	
Difficulty on restricting fluid intake				0.117
Yes	10 (38.5)	16 (61.5)	26 (36.6)	
No	26 (57.8)	19 (42.2)	45 (63.4)	
Dietary knowledge				1.000
≥50	20 (51.3)	19 (48.7)	39 (54.9)	
<50	16 (50.0)	16 (50)	32 (45.1)	
Nutrition literacy				0.511
≥50	22 (47.8)	24 (52.2)	46 (64.8)	
<50	14 (56.0)	11 (44.0)	25 (35.2)	

p-value from both chi-square and *Fisher Exact test; Significant p-value is bolded; RM: Ringgit Malaysia

variables' influence on adherence to renal diets is explored through various studies. In this study, a significant association with adherence status was established, which reported that the number of comorbidities is the only variable displaying statistical significance (p=0.003). Respondents with more than one comorbidity adhere to renal diet more (65.1%) than the respondents with one or no comorbidities (28.6%). The severity of the renal illness and its associated comorbidities was one of the effects of consuming restricted foods (Opiyo *et al.* 2019). Furthermore, participants perceive that diet and fluid recommendations as important (87.3% for diet, 91.5% for fluid), which aligns with a similar pattern seen in another study (Opiyo *et al.* 2019). Participants who thought the renal diet was crucial were more likely to follow instructions and recommendations (Lynch *et al.* 2018). The study was congruent, as observed that 56.5% of respondents with important perceptions towards renal diet reported adhering compared to non-adhering with 43.5%. A significant association was only observed in the perception of recommended diet but not in fluid restriction with a p-value of 0.014. The respondents were motivated to follow the recommended diet and fluid restriction due to perceived health benefits of 88.7% and 80.3% respectively. The respondents had more difficulty in watching diet recommendations as compared to difficulty in restricting fluid intake. As evidence, a higher (63.4%) respondent reported have no difficulty in restricting fluid intake as compared to (54.9%) respondent which was lower had no difficulty in watching diet recommendation. A significant association was also observed in difficulty in watching diet recommendations (p<0.001). The adherence was recorded by respondents with no difficulty while the non-adherence was recorded by participants with difficulty faced. The findings align with Opiyo *et al.* (2019) in their article that reported the significant association between difficulty in watching diet recommendations and fluid restriction with adherence status. However, this study did not show any significant association of difficulty in fluid restriction as the p-value of 0.117. Moreover, this study indicates that a majority of respondents possess higher

dietary knowledge (54.9%). However, despite the high knowledge, adherence status among these individuals (51.3%) was nearly equivalent to non-adherence (48.7%). Similarly, Alikari *et al.* (2019) demonstrated that educational interventions can enhance knowledge, adherence, and quality of life for hemodialysis patients, but no correlation was found between higher knowledge and increased adherence. The last independent variables, nutrition literacy showed that majority of the respondents recorded have higher nutrition literacy. Although nutrition literacy was reported to have a significant association with adherence of dietary adherence (Lim *et al.* 2020), however, this study failed to show any significant association. Furthermore, the data revealed that respondents with higher scores in nutrition literacy were more inclined towards non-adherence to the renal diet (52.2%) compared to adherence (47.8%).

Table 3 displayed that number of comorbidities was the only significant factors observed on sociodemographic variable. According to Tonelli *et al.* (2015), CKD patients who had more comorbid conditions been linked

Table 3. Univariate and multivariate analysis of factors associated to renal diet adherence status

Variables (n=71)	Dietary adherence			
	Unadjusted		Adjusted	
	OR (95% CI)	*p*	OR (95% CI)	*p*
Gender				
Male	0.22 (0.16−1.09)	0.074	0.23 (0.19−2.17)	0.468
Female	1.00	1.000	1.00	1.000
Ethnicity				
Malay	1.00	1.000	1.00	1.000
Non-Malay	1.69 (0.66−4.36)	0.276	3.22 (0.70−14.71)	0.132
Marital status				
Unmarried	1.00	1.000	0.24 (0.05−5.48)	0.581
Married	0.44 (0.10−1.92)	0.274	1.00	1.000
Years of education				
<6 years	1.00	1.000	1.00	1.000
≥6 years	0.28 (0.07−1.14)	0.180	0.19 (0.03−1.15)	0.07
Employment status				
Employed	1.00	1.000	1.00	1.000
Unemployed	2.00 (0.73−5.51)	0.180	1.68 (0.36−7.87)	0.510
Household income				
<RM4,850	1.00	1.000	1.00	1.00
≥RM4,850	1.25 (0.31−5.10)	1.000	2.38 (0.34−16.46)	0.38
Household size				
≤6 people	1.00	1.000	1.00	1.00
>6 people	1.71 (0.50−5.87)	0.391	1.09 (0.19−6.22)	0.93
The number of household income recipient				
≤1 person	1.00	1.000	1.00	1.000
>1 person	0.59 (0.22−1.56)	0.284	0.68 (0.14−3.18)	0.619

Continue from Table 3

Variables (n=71)	Dietary adherence			
	Unadjusted		Adjusted	
	OR (95% CI)	*p*	OR (95% CI)	*p*
Household food expenditure				
<RM500	1.20 (0.47−3.08)	0.705	0.25 (0.15−2.22)	0.417
≥RM500	1.00	1.000	1.00	1.000
Number of comorbidities				
One and below	1.00	1.000	1.00	1.000
More than one	4.67 (1.66−13.10)	**0.003**	9.22 (2.10−40.47)	**0.003**
Perception on recommended diet				
Important	10.37 (1.22−88.02)	**0.032**	13.20 (0.85−204.62)	0.065
Less important	1.00	1.000	1.00	1.000
Perception on fluid restriction				
Important	5.83 (0.65−52.74)	0.116	14.23 (0.63−323.09)	0.096
Less important	1.00	1.000	1.00	1.000
Motivation for following recommended diet				
Perceive health benefits	1.03 (0.24−4.50)	0.966	0.04	0.563
Other reasons	1.00	1.000	(0.02−8.93)1.00	1.000
Motivation for restricting fluid intake				
Perceive health benefits	1.04 (0.32−3.34)	0.953	2.22 (0.37−13.33)	0.384
Other reasons	1.00	1.000	1.00	1.000
Difficulty in watching diet recommendation				
Yes	0.04 (0.02−0.16)	**<0.001**	(0.003−0.13)1.00	**<0.001**
No	1.00	1.000	0.04	1.000
Difficulty in restricting fluid intake				
Yes	0.04 (0.17−1.23)	0.120	4.04 (0.56−28.96)	0.165
No	1.00	1.000	1.00	1.000
Fluid adherence				
Adherence	2.40 (0.92−6.25)	0.074	1.15 (0.23−5.73)	0.864
Non-adherence	1.00	1.000	1.00	1.000
Dietary knowledge (score)	1.00 (0.98−1.01)	0.605	0.99 (0.97−1.01)	0.356
Dietary knowledge (category)				
≥50	1.00	1.000	1.00	1.000
<50	0.95 (0.37−2.42)	0.914	0.84 (0.31−2.27)	0.724
Nutrition literacy (score)	1.01 (0.99−1.02)	0.378	1.01 (0.99−1.03)	0.183
Nutrition literacy (category)				
≥50	1.00	1.000	1.00	1.000
<50	1.39 (0.52−3.70)	0.511	1.48 (0.52−4.21)	0.461

Significant odds ratios are bolded (p<0.05); OR: Odds Ratio; CI: Confidence Interval

to worse outcomes, including all-cause mortality, hospitalization, and longer hospital stays. Thus, CKD patients with higher comorbidity that are aware and conscious of the issue will tend to adhere to recommendations. Proven in this present study, the respondents with comorbidities more than one are 9 times more likely to adhere to the renal diet as compared to the respondents with one or no comorbidities (AOR=9.22, 95% CI: 2.10–40.47). A study from Taghdir *et al.* (2016) is congruent as they recorded that better dietary compliance is seen in patients with comorbidities. Univariate logistic regression analysis in Table 3 highlighted significant associations with perception of recommended diet, and difficulty in watching diet recommendations. However, multivariate logistic regression further identified the main factors significantly associated with adherence to the renal diet: difficulties in watching diet recommendations. Similarly, Opiyo *et al.* (2019) in their study showed that one of the significant factors in dietary adherence was difficulties in following diet recommendations. Respondents who reported having difficulty in adhering to the renal diet are less likely to adhere to the renal diet. The existence of the difficulty is the challenge and barrier towards dietary adherence.

As observed in Table 4, unable to avoid certain unrecommended food was the most difficult faced by the respondent in this study. Moreover, unwilling to control what they want to eat and did not understand what type of diet should be followed also appeared to be the difficulty faced by the respondent. The study was congruent with Opiyo *et al.* (2019) that showed the main difficulty faced was unable to avoid certain food. Overcoming the challenges described by respondents should be approached gradually to enhance dietary adherence. In contrast, both dietary knowledge and nutrition literacy did not emerge as significant factors in this study.

The difficulty CKD patients face in limiting specific foods may stem from inadequate dissemination of nutrition information, leading to a poor understanding of dietary prescriptions. These challenges should be addressed progressively to enhance adherence. It is also essential for patients to fully understand the role of diet in managing disease progression and symptoms, enabling them to better appreciate and follow dietary recommendations (Lynch *et al.* 2018). However, this study has a few limitations, particularly concerning data collection from older patients with memory loss, which could introduce errors and biases. To improve future research, involving caretakers during data collection is recommended for more accurate data. Additionally, conducting larger cross-sectional studies in private dialysis centers in Selangor to observe adherence factors, investigate the determinants of non-adherence, and explore the correlations between sociodemographic factors, nutrition literacy, and dietary adherence are suggested.

Table 4. Types of difficulty towards dietary adherence

Difficulty faced (n=71)	n (%)
Unable to consume a variety of foods	1 (1.4)
Do not understand what type of diet to follow	5 (7.0)
Unwilling to control food I want to eat	9 (12.7)
Unable to avoid certain unrecommended food	17 (23.9)
Not applicable: No difficulty	39 (54.9)

CONCLUSION

This present study concluded that dietary adherence among dialysis patients in private dialysis centers was higher compared to other studies, with a significant association found between the number of comorbidities, perception, and difficulty with recommended diets. Patients with multiple comorbidities were nine times more likely to adhere to the renal diet, while those facing difficulties in following the recommended diet were less likely to adhere to it. Additionally, it is crucial for patients to fully understand the role of diet in reducing disease progression and managing symptoms, enabling them to comprehend and value the rationale behind dietary recommendations. The difficulty in avoiding certain food that is observed to be the main obstacle to dietary adherence should be investigated further in the future to improve dietary adherence.

ACKNOWLEDGEMENT

We would like to express our gratitude to all selected private dialysis centers in Selangor

for the approval to conduct this research and also to the participants who willingly take part in this research. We would also like to thank Universiti Teknologi MARA Research Management Centre (UiTM RMC) for providing financial support for this study through Geran Khas Penyelidikan (600-RMC/GPK 5/3 (147/2020).

DECLARATION OF CONFLICT OF INTERESTS

The authors have no conflict of interest.

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