

ORIGINAL ARTICLE

Quality of Life, Outcomes

Analysis of the Relationship Between Self-Efficacy, Adherence With Diet Therapy and Fluid Control in Patients Receiving Hemodialysis Treatment: A Structural Equation Analysis

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ABSTRACT

Purpose: Hemodialysis treatment presents physical, emotional, and social challenges for patients, impacting their overall well-being and daily life. Successful management requires adherence to fluid restrictions, dietary guidelines, and regular medication intake. This study explored the associations between self-efficacy, dietary adherence, and fluid control in patients undergoing hemodialysis.

Methods: This cross-sectional, descriptive study was conducted from 15 April 2024 to 15 June 2024, involving 197 patients receiving hemodialysis at a public hospital and a private dialysis center in Erzurum, eastern Turkey. Data were collected using a Personal Information Form, the General Self-Efficacy Scale, the Fluid Control in Hemodialysis Patients Scale, and the Attitude Scale for Dietary Therapy of Hemodialysis Patients. Descriptive statistics and structural equation modeling were used for analysis. A Bayesian estimator assessed direct and indirect relationships between variables. The model's reliability and validity were assessed using various statistical tests.

Results: Participants had an average age of 53.3 years and an average duration on dialysis of 6.7 years. Of the participants, 91.4% regularly monitored their weight, and 65% regularly monitored edema. The average scores were 28.35 (5.92, SD) on the General Self-Efficacy Scale, 45.8 (8.12) on the Attitude Scale for Dietary Therapy, and 49.0 (9.05) on the Fluid Control Scale. Self-efficacy had a significant positive indirect association with fluid control through dietary adherence ($\beta = 0.126$, 95% confidence interval [0.008, 0.277]). The total association between self-efficacy and fluid control was also significant ($\beta = 0.624$, 95% confidence interval [0.483, 0.755]), with dietary adherence partially mediating this relationship. Self-efficacy accounted for 31% of the variance in dietary adherence, and the overall model explained 41% of the variance in fluid control.

Conclusion: Higher self-efficacy was associated with better dietary adherence and improved fluid control. Dietary adherence partially mediated the association between self-efficacy and fluid control. Healthcare providers may consider strategies to enhance self-efficacy in hemodialysis patients to support dietary adherence and fluid control, potentially improving treatment outcomes, and quality of life.

1 | Introduction

Dialysis treatment poses physical, emotional, and social challenges for patients with chronic kidney disease (CKD), impacting their well-being [1, 2]. Self-efficacy, defined as confidence in performing tasks successfully, is critical for managing chronic diseases like CKD [3, 4]. High self-efficacy is linked to better quality of life, lower depression, and improved adaptation to lifestyle changes such as dietary and fluid restrictions [5–7]. Conversely, low self-efficacy in hemodialysis patients is associated with difficulties in daily activities and poor treatment adherence [8, 9].

Hemodialysis patients face complex dietary and fluid restrictions, which are among the most challenging to follow [10–12]. Non-adherence to these restrictions is common, with studies reporting 47%–72% non-compliance with diet and 50%–71% with fluid restrictions [10].

Fluid restriction, in particular, is a major source of stress and non-adherence [7, 13]. Non-adherence can lead to worsened symptoms, electrolyte imbalances, fluid overload, increased hospitalizations, higher healthcare costs, and elevated mortality [14–16]. Self-efficacy strongly correlates with adherence, particularly to fluid restrictions, where higher confidence improves compliance [17].

This study investigated self-efficacy levels, dietary adherence, and fluid restriction adherence in hemodialysis patients. It explored the relationships among these factors and examined whether dietary adherence mediates the link between self-efficacy and fluid restriction adherence. The findings aim to inform targeted interventions, such as educational programs and behavioral support, to enhance adherence, improve outcomes, and reduce complications in hemodialysis patients.

2 | Methods

2.1 | Type of Research

The study has a cross-sectional descriptive-correlational design. The Proposed Model of the present study is as shown in Figure 1.

2.2 | Setting and Participants

This study involved 230 patients from two dialysis centers (one state, one private) in Erzurum, eastern Turkey, between 15 April 2024 and 15 June 2024. Using a known universe sample calculation with a 95% confidence interval and a 5% margin of error, the minimum sample size required was 144 (<https://www.qualtrics.com/blog/calculating-sample-size/>). After excluding 27 patients who did not meet the inclusion criteria (age ≥ 18 , Turkish comprehension, hemodialysis for ≥ 6 months, no cognitive issues) and six who declined participation, the study concluded with 197 patients. This represents 86% of the target sample, indicating an adequate sample size [18].

2.3 | Data Collection Tools

Personal Information Form, General Self-Efficacy Scale (GSES), Attitude Scale for the Dietary Therapy of Hemodialysis Patients (ASDTHP) and Fluid Control in Hemodialysis Patients Scale (FCHPS) were used in the study to collect data.

2.3.1 | Personal Information Form

The patient information form, developed by researchers, assessed sociodemographic and disease characteristics through 12 questions. These covered age, gender, education, marital status, employment, income, chronic disease presence, weekly dialysis frequency, weekly dialysis duration, regular weight monitoring, regular edema monitoring, and diagnosis year.

2.3.2 | General Self-Efficacy Scale

Schwarzer and Jerusalem [19] developed the scale in 1979 and Usta Yeşilbalkan et al. [20] adapted it to the Turkish population after a validity and reliability study in patients undergoing peritoneal dialysis. The Turkish form includes 10 items, each scored between 1 and 4. The lowest possible score of the scale is 10, and the highest possible score is 40. Higher scores show higher self-efficacy. Cronbach's alpha of the scale was found to be 0.88.

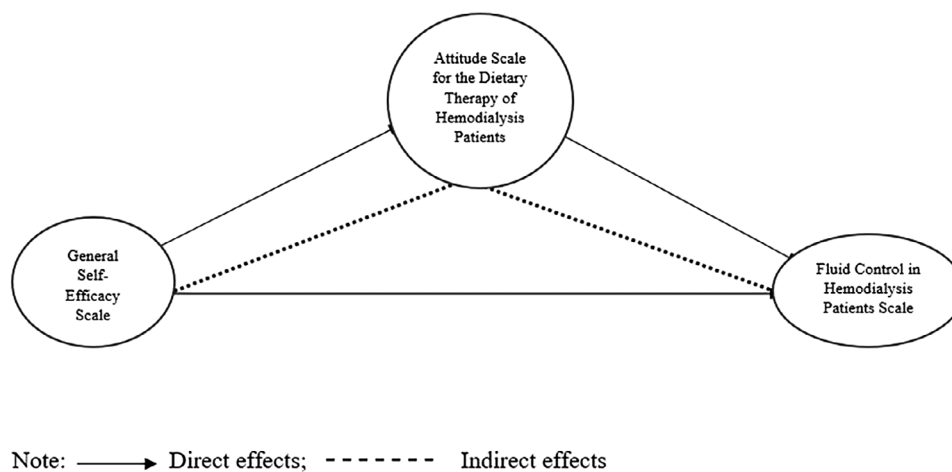


FIGURE 1 | Proposed model.

2.3.3 | Attitude Scale for the Dietary Therapy of Hemodialysis Patients

Onbe and Kanda [21] developed this 16-item scale in 2018 for the aim of examining attitudes of hemodialysis patients toward diet therapy. Turkish validity and reliability was performed by Bahçecioglu Turan et al. [22]. It is a 4 Likert type scale. Items represent the responses “4-Strongly Agree, 3-Agree, 2-Disagree, 1-Strongly Disagree.” This scale has three sub-dimensions. The first sub-dimension; “propensity of behavior that is affected by cognition (BTC)” includes seven items (1–7). The second sub-dimension; “propensity of behavior that is affected by food culture (BTFC)” includes six items (8–13). The third sub-dimension “negative affect that modifies the diet (NECD)” includes three items (14–16). These last three items are reversed in the scale. Higher scores mean better attitudes. Cronbach's alpha of the scale was found to be 0.84.

2.3.4 | Fluid Control in Hemodialysis Patients Scale

Albayrak Cosar and Cinar Pakyüz [23] developed this 24-item scale to evaluate fluid control in Turkish hemodialysis patients. The scale has three sub-dimensions as “knowledge,” “behavior,” and “attitude.” The answers given to the statements are in a three-point Likert type, and “agree” is evaluated as three points, “undecided” as two points, and “disagree” as one point. The items 6, 7, 18, 19, 20, 21, 22, 23, and 24 in the scale are reversely scored. Possible scores of the sub-dimensions are between 7 and 21 for the knowledge sub-dimension, between 11 and 33 for the behavior sub-dimension, between 6 and 18 for the attitude sub-dimension, and between 24 and 72 for the general scale. Higher scores on the scale are interpreted as an increase in patients' adherence to fluid control. Cronbach's alpha value of the scale was found to be 0.88.

2.4 | Data Collection

Data were collected from patients receiving hemodialysis treatment at a state hospital and a private dialysis center during the specified date range. Data forms were collected by the researcher using a face-to-face interview method after the patients were connected to dialysis. Filling out the data forms took approximately 20–25 min.

2.5 | Data Analysis

The findings obtained from the research were analyzed in SPSS 25 package program. Confirmatory factor analyses (CFA) and structural equation modeling (SEM) analyses were performed with Mplus 8.10. Descriptive analyses of the variables were then performed; mean scores and standard deviation values were calculated, and correlation analyses were performed. SEM was performed to determine the relationships between variables. For each latent variable, 95% CI was reported, and estimates were considered significant if the CI did not include zero [24]. In order to better understand the R^2 explanation percentages, the findings of Cohen's f^2 analysis were analyzed. Cohen's f^2 value was interpreted as small for $f^2 \geq 0.02$, medium for $f^2 \geq 0.15$, and large for

$f^2 \geq 0.35$ [25]. Correlation values were determined as 0.01–0.39 weak, 0.40–0.69 moderate, 0.70–0.89 strong, 0.90–1.00 very strong correlation. The Proposed Model of the present study is as shown in Figure 1. The Bayesian estimator was used because it performs well in analyses requiring numerical integration and provides more robust estimates in small samples compared to frequentist estimators.

3 | Results

In the study, the mean age of the participants was found to be 53.3 ± 15.9 years, and the mean diagnosis year was found to be 6.73 ± 5.35 . It was found that 54.3% were male, 70.6% were married, 29.9% were elementary school graduates, 74.1% were not working, 61.9% had an income equal to expenses (moderate level), 62.9% had another chronic disease, 82.7% had a hemodialysis schedule three times a day 68.5% received dialysis for 4 h, 91.4% monitored weight regularly, and 65% monitored edema regularly (Table 1). The study was terminated with 197 patients (27 patients did not meet the research criteria and 6 patients refused to participate).

3.1 | Statistical Analysis

It was found that Cronbach's alpha internal consistency coefficients ranged between 0.85 and 0.93, and Cronbach's alpha for the whole scale and its sub-dimensions was above the threshold value of 0.70. It was also found that McDonald's Omega values ranged between 0.84 and 0.94. The mean total score for the General Self-Efficacy Scale was 28.4 ± 5.92 . The mean total score was 45.8 ± 8.12 for the Attitude Scale for the Dietary Therapy of Hemodialysis Patients, 21.7 ± 4.05 for the BTC sub-dimension, 16.8 ± 4.73 for the BTFC sub-dimension, and 7.35 ± 2.45 for the NECD sub-dimension. The mean total score was 49.0 ± 9.05 for the Fluid Control in Hemodialysis Patients Scale, 13.2 ± 3.77 for the Knowledge sub-dimension, 22.6 ± 5.26 for the Behavior sub-dimension, and 13.3 ± 3.08 for the Attitude sub-dimension. Correlation analysis results showed a moderate significant relationship between the General Self-Efficacy Scale and the Attitude Scale for the Dietary Therapy of Hemodialysis Patients ($r=0.50$, $p<0.001$) and a moderate significant relationship between the General Self-Efficacy Scale and the Fluid Control in Hemodialysis Patients Scale ($r=0.51$, $p<0.001$); there was also a moderate significant relationship between the Attitude Scale for the Dietary Therapy of Hemodialysis Patients and the Fluid Control in Hemodialysis Patients Scale ($r=0.44$, $p<0.001$) (Table 2).

3.2 | Bayesian Mediation Analysis

The model convergence that we tested using the Bayesian estimator was achieved at 3200 iterations and the PSR value decreased to less than 1.05 (1.048), but there were noticeable variations in the trace plots. We checked the PSR values by increasing the number of iterations with the TECH8 command and found that the variation in the trace plots was minimized at 30000 iterations, showing that the model should not be rejected [26].

TABLE 1 | Descriptive characteristics.

Characteristics	Number (n = 197)	%
Gender		
Female	90	45.7
Male	107	54.3
Marital status		
Married	139	70.6
Single	54	29.4
Educational status		
Illiterate	46	23.4
Literate	24	12.2
Elementary school	59	29.9
Secondary school	23	11.7
High school	27	13.7
University	18	9.1
Working status		
Yes	51	25.9
No	146	74.1
Income status		
Income < expense	29	14.7
Income = expense	122	61.9
Income > expense	46	23.4
Presence of another chronic disease		
Yes	124	62.9
No	73	37.1
Weekly number of dialysis		
Two times a week	34	17.3
Three times a week	163	82.7
Duration of weekly dialysis		
2.5 h	26	13.2
3.5 h	36	18.3
4 h	135	68.5
Regular weight monitoring		
Yes	180	91.4
No	17	8.6
Regular edema monitoring		
Yes	128	65.0
No	69	35.0
	Mean ± SD	Min–Max
Age (years)	53.3 ± 15.9	18–86
Diagnosis year (years)	6.73 ± 5.35	1–25

TABLE 2 | Preliminary analysis results (n = 197).

Variable	M (SD)	α	ω	GSES	ASDTHP	BTC	BTFC	NECD	FCHPS	Knowledge	Behavior	Attitude
GSES	28.4 (5.92)	0.85	0.84	1								
ASDTHP	45.8 (8.12)	0.88	0.89	0.50**	1							
BTC	21.7 (4.05)	0.89	0.89	0.41*	0.82**	1						
BTFC	16.8 (4.73)	0.93	0.94	0.45*	0.87**	0.59**	1					
NECD	7.35 (2.45)	0.87	0.87	0.10	0.25**	−0.07	−0.01	1				
FCHPS	49.0 (9.05)	0.88	0.87	0.51**	0.44**	0.37**	0.37**	0.13	1			
Knowledge	13.2 (3.77)	0.86	0.86	0.43**	0.38**	0.25**	0.30**	0.27**	0.77**	1		
Behavior	22.6 (5.26)	0.85	0.85	0.40**	0.31**	0.27**	0.24**	0.11	0.85**	0.51**	1	
Attitude	13.3 (3.08)	0.84	0.84	0.28**	0.28**	0.30**	0.30**	−0.13	0.52**	0.18**	0.18**	1

Abbreviations: α, Cronbach's alpha; ω, McDonald's OMEGA; ASDTHP, attitude scale for the dietary therapy of hemodialysis patients; BTC, propensity of behavior that is affected by cognition; BTFC, propensity of behavior that is affected by food culture; FCHPS, fluid control in hemodialysis patients scale; GSES, general self-efficacy scale; NECD, negative affect that modifies the diet.

*p < 0.05.

**p < 0.001.

Table 3 shows the direct, indirect, and total effects of the structural model. The direct effect between General Self-Efficacy Scale and Attitude Scale for the Dietary Therapy of Hemodialysis Patients was positive and significant ($\beta=0.563$, 95% CI [0.433, 0.682]), the direct effect between General Self-Efficacy Scale and Fluid Control in Hemodialysis Patients Scale was positive and significant ($\beta=0.498$, 95% CI [0.293, 0.671]), and the direct effect between Attitude Scale for the Dietary Therapy of Hemodialysis Patients and Fluid Control in Hemodialysis Patients Scale was positive and significant ($\beta=0.224$, 95% CI [0.002, 0.454]). The indirect relationship of General Self-Efficacy Scale with Fluid Control in Hemodialysis Patients Scale through Attitude Scale for the Dietary Therapy of Hemodialysis Patients was positive and significant ($\beta=0.126$, 95% CI [0.008, 0.277]). The total effect of General Self-Efficacy Scale on Fluid Control in Hemodialysis Patients Scale ($\beta=0.624$, 95% CI [0.483, 0.755]) was positive and significant. This result showed that Attitude Scale for the Dietary Therapy of Hemodialysis Patients had a partial mediating effect in the relationship between General Self-Efficacy Scale and Fluid Control in Hemodialysis Patients Scale. The structural model established within the scope of the study explains 31% of the variance in Attitude Scale for the Dietary Therapy of Hemodialysis Patients and 42% of the variance in Fluid Control in Hemodialysis Patients Scale. Cohen's f^2 analysis showed that the level of explanation of Fluid Control in Hemodialysis Patients Scale by General Self-Efficacy Scale was small ($f^2=0.12$) and the level of explanation of Fluid Control in Hemodialysis Patients Scale by General Self-Efficacy Scale and Attitude Scale for the Dietary Therapy of Hemodialysis Patients together was large ($f^2=0.529$) (Table 3).

4 | Discussion

This study examined the relationships between self-efficacy, dietary adherence, and fluid control among patients undergoing hemodialysis. The findings indicate that patients generally exhibit moderate levels of self-efficacy, adherence to dietary intake, and fluid management.

Studies by Jafari et al. [27], Purba et al. [28], Biçer and Yılmaz Karabulutlu [29], Hafezieh et al. [30], and Almutary and Tayyip

[4] found that patients with chronic kidney disease (CKD) exhibit moderate self-efficacy levels. This suggests adequate motivation during treatment, though not optimal. Effective CKD management relies on patients' self-management skills, including lifestyle changes, symptom management, medication adherence, and coping with physical and psychosocial challenges [31]. For patients with end-stage kidney disease (ESKD), higher self-efficacy correlates with better self-management. Critical care nurses play a key role in enhancing patients' self-efficacy [4]. Bandura's self-efficacy theory posits that a strong belief in one's ability to perform a behavior increases the likelihood of sustaining it. The studies noted moderate self-efficacy and moderate compliance with diet and fluid control, aligning with the theory that self-efficacy influences health behaviors. Interestingly, the theory also suggests a bidirectional relationship: behavior can enhance self-efficacy. Moderate compliance with diet and fluid control may reinforce patients' confidence, indicating that self-efficacy is both a cause and an effect. Interventions to boost self-efficacy should thus focus on encouraging small, achievable behavioral changes.

Ahrari et al. [32], Opiyo et al. [33], and Çiftçi et al. [34] found that dietary adherence among hemodialysis patients is moderate, consistent with our study. A meta-analysis also reported moderate dietary compliance, indicating that while some patients follow restrictions, occasional violations occur [10]. Non-adherence can lead to serious health issues, including electrolyte imbalances, fluid overload, and cardiovascular complications. Moderate adherence may stem from insufficient knowledge about nutritional management or low motivation, which may not adequately protect patients' health [35]. The kidney diet, known for its complexity due to numerous restrictions, is challenging to teach, understand, and follow. Restrictions on foods like fruits, vegetables, and dairy—due to their potassium or phosphate content—often conflict with typical healthy eating advice [35, 36]. Patients report distress from these restrictions, expressing desires to eat or drink beyond limits and struggling with constant thirst [37]. Most (83.8%) find the diet restrictive, and 61.8% face difficulties adhering to it, particularly with avoiding certain foods and fluids. Less restrictive dietary prescriptions requiring minimal effort are easier for hemodialysis patients to follow [33].

TABLE 3 | Standardized results for Bayesian mediation model.

	β	S.E.	z	95% CI		p	R ²
				Lower	Upper		
Direct effect							
GSES → ASDTHP	0.563	0.077	7.311	0.433	0.682	<0.001	0.317
GSES → FCHPS	0.498	0.115	4.330	0.293	0.671	<0.001	
ASDTHP → FCHPS	0.224	0.140	1.601	0.002	0.454	<0.001	
Indirect effect							
GSES → ASDTHP → FCHPS	0.126	0.081	1.555	0.008	0.277	<0.001	
Total effect							
GSES → FCHPS	0.624	0.086	7.255	0.483	0.755	<0.001	0.423

Abbreviations: ASDTHP, attitude scale for the dietary therapy of hemodialysis patients; FCHPS, fluid control in hemodialysis patients scale; GSES, general self-efficacy scale.

Studies by Karabulutlu and Yılmaz [38], Atik et al. [39], Kaplan and Karadağ [40], and Demiralp and Taşkın Yılmaz [41] indicate moderate fluid control among hemodialysis patients, reflecting challenges in managing fluid intake and treatment processes. Adherence to fluid restrictions is closely tied to patients' self-efficacy, underscoring the need for education and counseling to enhance compliance. Successful hemodialysis treatment requires adherence to diet, dialysis schedules, and fluid restrictions, with fluid control being the most challenging [13, 40]. Despite high knowledge levels about fluid restrictions reported in these studies, some patients still lack sufficient understanding, which hinders adherence [7, 29, 39–41]. Knowledge significantly influences positive attitudes and behaviors, with better-informed patients showing higher compliance compared to those with limited knowledge [42]. Insufficient information is a key risk factor for excessive fluid intake, while greater knowledge boosts self-confidence, enabling patients to better follow health professionals' recommendations and reduce fluid overload risks. A major barrier to fluid control is the use of technical terms by health professionals, which confuses patients and obscures the purpose of restrictions [36, 42–46].

This study found that self-efficacy positively influences dietary adherence and fluid control. Higher self-efficacy is linked to greater adherence to dietary recommendations and fluid restrictions [35]. Research by John et al. [47] and Gartika et al. [48] confirms a strong correlation between self-efficacy and adherence to daily nutritional and fluid restrictions. As patients' self-efficacy increases, their ability to manage dietary and fluid challenges improves, enhancing treatment outcomes [14, 35, 48].

The study revealed that dietary adherence enhances fluid control in hemodialysis patients. Mersal et al. [49] found that patients with greater knowledge and a positive attitude toward dietary adherence showed better fluid restriction compliance. Chan et al. [50] noted diet as a key factor in fluid control adherence. Interestingly, patients struggling with dietary prescriptions often adhere better to fluid restrictions [33]. Self-efficacy strengthens fluid control through dietary adherence, a critical component of treatment success [35, 48]. However, patients' understanding of adherence often differs from healthcare professionals' expectations, with many believing fluid restriction compliance equates to overall adherence [1]. Inadequate monitoring of fluid or high-sodium intake and body weight at home contributes to dietary non-adherence, a persistent health issue [46]. Adhering to a daily fluid intake of 1–1.5 L helps patients control weight gain between dialysis sessions, emphasizing the role of dietary adherence in maintaining fluid balance [51].

4.1 | Limitations of the Study

Due to the cross-sectional design of the study, it was not possible to investigate dynamic changes over time. Because of the small sample size and limited sample selection, it is not possible to generalize the results. Since a self-reported measure was used, there may have been information bias.

5 | Conclusion

In hemodialysis patients, self-efficacy, dietary adherence, and fluid restriction compliance were found to be moderate but suboptimal. The study confirms that self-efficacy positively influences dietary adherence and fluid control, with dietary adherence mediating the effect on fluid control. These findings align with Social Cognitive Theory, highlighting self-efficacy's role in health behaviors. The study underscores the potential of self-efficacy-focused interventions, such as individualized education, behavioral coaching, and psychosocial support, to enhance dietary, and fluid adherence in hemodialysis patients. However, further research is needed to evaluate specific interventions and explore other psychosocial factors. Longitudinal studies on self-efficacy's impact on long-term health outcomes could further enrich health psychology literature.

Acknowledgments

The authors are grateful to all participants who agreed to participate voluntarily in this study.

Ethics Statement

Approval (date 21.03.2024 and number 2024/05–6) was taken from University Ethics Committee. The individuals were informed that participation in the study was voluntary, the information to be obtained from the study would be used entirely for research purposes and would be kept confidential. The individuals were asked to answer all questions completely, appropriately, without any pressure or suggestion from anyone, and sincerely. The participants gave written informed consent for the study, which was conducted in accordance with the principles of the Helsinki Declaration of Human Rights.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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