



THE EFFECT OF EDUCATION GIVEN TO HEMODIALYSIS PATIENTS ON SELF-CARE AGENCY AND FLUID CONTROL: A RANDOMIZED CONTROLLED TRIAL

HEMODİYALİZ HASTALARINA VERİLEN EĞİTİMİN HASTALARIN ÖZ-BAKIM GÜCÜ VE SIVI KONTROLÜNE ETKİSİ

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ABSTRACT

Objective: This study investigated the effects of education on hemodialysis management provided to patients receiving hemodialysis treatment on self-care agency and fluid control.

Method: The study was conducted using a randomized controlled experimental design. Participants receiving hemodialysis treatment were divided into two groups: the intervention group (n=26) and the control group (n=28). Data were collected using the Descriptive Information Form, Self-Care Agency Scale, and Fluid Control in Hemodialysis Patients Scale. The intervention group received individualized education based on the educational booklet entitled "Living with Hemodialysis," followed by weekly telephone follow-up for seven weeks. Patients in the control group received standard nursing care in accordance with the institution's routine practices. Eight weeks after the pre-test, the measurement tools were re-administered to both groups. The study was conducted in accordance with the CONSORT guidelines for reporting randomized controlled clinical trials.

Results: The post-test scores of the Fluid Control in Hemodialysis Patients Scale were significantly higher than the pre-test scores in both the intervention and control groups. The frequency of hemodialysis significantly decreased following the education in the intervention group, and the post-test frequency of hemodialysis was significantly lower than that of the control group. Self-care agency increased significantly in the intervention group; however, no significant difference was found between the groups in post-test self-care agency. A significant increase in self-care agency from pre-test to post-test was also observed in the control group.

Conclusion: Structured education on hemodialysis management improved fluid control and reduced the frequency of hemodialysis in the intervention group. Although self-care agency increased significantly in the intervention group, no significant difference was found between the groups in post-test self-care agency. The integration of structured hemodialysis education into routine nursing care in an effective and sustainable manner recommended to support self-management and fluid control among patients receiving hemodialysis treatment.

Key Words: Renal Dialysis, Education, Nursing, Self-Care, Fluid Therapy

ÖZ

Amaç: Bu çalışmada, hemodiyaliz tedavisi alan hastalara hemodiyaliz yönetimine yönelik verilen eğitimin öz-bakım gücü ve sıvı kontrolü üzerindeki etkileri araştırıldı.

Yöntem: Çalışma, randomize kontrollü bir deneysel tasarımda yürütüldü. Hemodiyaliz tedavisi alan katılımcılar müdahale grubu (n=26) ve kontrol grubu (n=28) olmak üzere iki gruba ayrıldı. Veriler; Tanıtıcı Bilgi Formu, Öz-Bakım Gücü Ölçeği ve Hemodiyaliz Hastalarında Sıvı Kontrolü Ölçeği kullanılarak toplandı. Müdahale grubuna "Hemodiyaliz ile Yaşamak" adlı eğitim kitapçığı temel alınarak bireyselleştirilmiş eğitim verildi ve ardından yedi hafta boyunca haftalık telefonla takip yapıldı. Kontrol grubundaki hastalar ise kurumun rutin uygulamaları doğrultusunda standart hemşirelik bakımı aldı. Ön testten sekiz hafta sonra ölçüm araçları her iki gruba yeniden uygulandı. Çalışma, randomize kontrollü klinik araştırmaların raporlanmasına ilişkin CONSORT yönergelerine uygun olarak yürütüldü.

Bulgular: Hemodiyaliz Hastalarında Sıvı Kontrolü Ölçeği son test puanlarının, hem müdahale hem de kontrol gruplarında ön test puanlarına göre anlamlı düzeyde daha yüksek olduğu belirlendi. Müdahale grubunda eğitim sonrasında hemodiyalize girme sıklığı anlamlı düzeyde azaldı ve son testteki hemodiyalize girme sıklığı kontrol grubuna göre anlamlı düzeyde daha düşüktü. Müdahale grubunda öz-bakım gücü anlamlı düzeyde arttı; ancak son test öz-bakım gücü açısından gruplar arasında anlamlı bir fark bulunmadı. Kontrol grubunda da öz-bakım gücünde ön testten son teste anlamlı bir artış gözlemlendi.

Sonuç: Hemodiyaliz yönetimine yönelik yapılandırılmış eğitim, müdahale grubunda sıvı kontrolünü iyileştirmiş ve hemodiyalize girme sıklığını azaltmıştır. Öz-bakım gücü müdahale grubunda anlamlı düzeyde artmasına rağmen, son test öz-bakım gücü açısından gruplar arasında anlamlı bir fark bulunmamıştır. Yapılandırılmış hemodiyaliz eğitiminin, hemodiyaliz tedavisi alan hastalarda öz-yönetimi ve sıvı kontrolünü desteklemek amacıyla rutin hemşirelik bakımına etkili ve sürdürülebilir biçimde entegre edilmesi önerilmektedir.

Anahtar Kelimeler: Böbrek Diyalizi, Eğitim, Hemşirelik, Öz-Bakım, Sıvı Tedavisi

Article Info/Makale Bilgisi

Submitted/Yükleme tarihi: 25.11.2025, Revision requested/Revizyon isteği: 15.02.2026, Last revision received/Son düzenleme tarihi: 23.02.2026, Accepted/Kabul: 24.03.2026

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INTRODUCTION

Nursing, arising from human needs, aims to protect, maintain, and improve the health of individuals, families, and communities, whether healthy or ill. In line with this purpose, it evaluates individuals, families, and communities from a holistic and integrative perspective and provides the necessary healthcare services [1]. The primary responsibility of nurses is to provide care for individuals and enhance their quality of life [2]. In this context, nurses fulfill their duties by utilizing various roles, such as educator, decision-maker, counselor, manager, researcher, and caregiver, among others [3]. Nurses hold significant responsibilities in the care and management of chronic diseases, which require lifelong care and monitoring [4].

One of the major chronic diseases requiring lifelong care is Chronic Kidney Disease (CKD). Chronic kidney disease is a global public health issue, affecting approximately 10% of the world's population [5]. The prevalence of CKD is 3.31% in Norway and 17.3% in Germany, both European countries [6]. In the United States, CKD is observed in one out of every seven adults [7]. In Turkey, CKD affects 15.7% of the adult population [8]. Renal replacement therapy options for CKD include peritoneal dialysis, hemodialysis (HD), and kidney transplantation. Among these, HD is the most commonly applied treatment method [9]. The primary goal of HD is to correct fluid and electrolyte imbalances, prevent potential complications, compensate for the lost kidney functions as much as possible, and improve the patient's quality of life [10]. However, HD also leads to various challenges for patients, including dietary and fluid restrictions, depression, job loss, loss of roles within family life, fear of death, and a decline in self-care agency [11].

Self-care agency is defined as "a dynamic process that enables individuals to manage their own healthcare" [12]. A lack of self-care agency makes it more challenging for individuals to adapt to their illness, which in turn negatively impacts treatment outcomes and increases the overall cost of the disease [13]. In HD patients, self-care behaviors include adhering to an appropriate diet, taking medications regularly, complying with fluid restrictions, and coping with stress. Studies have shown that higher levels of self-care in HD patients are associated with better treatment adherence, more health-promoting behaviors, and fewer physical and psychological symptoms [14,15]. Therefore, improving self-care agency is crucial for preserving and enhancing the quality of life of HD patients and for mitigating their symptoms [13].

In HD, fluid restriction is the most stress-inducing and challenging aspect for treatment adherence [16]. The prevalence of non-adherence to fluid restrictions ranges between 30-74% [17]. As the disease progresses, HD patients may lose their ability to produce urine, making fluid management increasingly challenging [18]. Moreover, fluid overload in these patients increases mortality rates [19]. Adherence to fluid restriction improves treatment outcomes and prolongs patients' lives. For this reason, controlling fluid intake must become a lifestyle component in disease management [20].

It has been reported that nursing care and education play a crucial role in addressing existing or potential problems faced by individuals undergoing HD treatment [21]. The literature highlights that education provided by nurses to HD patients has positive effects on various parameters, including dietary adherence [22], disease adaptation [23], fluid control [22,24], self-care [25,26], knowledge about HD [27], medication adherence [26] and self-efficacy [25]. Considering that self-care agency determines patients' ability to maintain daily treatment-related behaviors [28] and fluid restriction directly affects morbidity and mortality in hemodialysis [29], these variables constitute key components of effective disease management. However, educational interventions focusing simultaneously on both outcomes remain limited in the literature. Therefore, this study aimed to examine the effects of nurse-led education provided to hemodialysis patients on self-care agency and fluid control.

METHOD

Study Design and Participants

This study aimed to evaluate the effect of education on HD management provided to patients undergoing hemodialysis treatment on their self-care agency and fluid control. The research is a randomized controlled trial with a pre-test and post-test comparative design. The study followed the Consolidated Standards of Reporting Trials (CONSORT) guidelines (Figure 1).

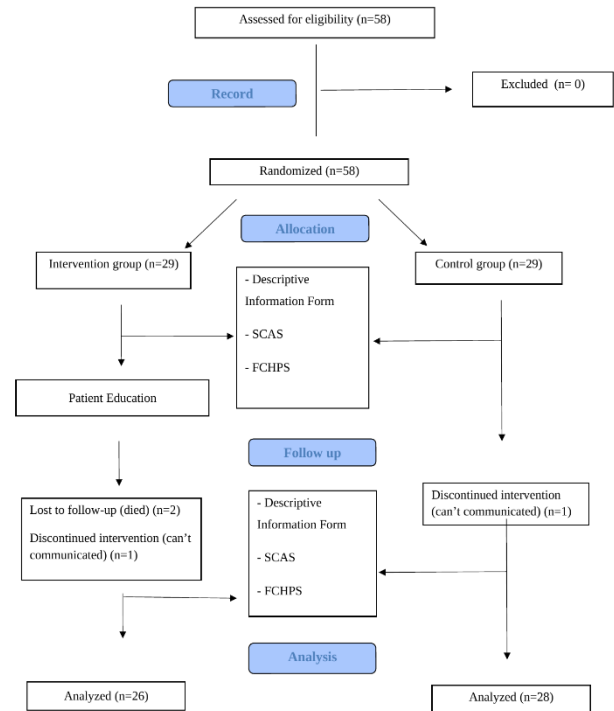


Figure 1. Consort 2010 Research Application Diagram

The study population consisted of patients receiving HD treatment at the Dialysis Unit of Atatürk University Health Research and Application Center between May and December 2023. The unit is staffed by three physicians and seven nurses and provides treatment to 62 registered patients. Using the G*Power 3.1.9.2 program, it was calculated that a total of 50 patients, with a minimum of 25 patients per group, would be sufficient to achieve a significance level of 0.05 and a power of 90% [30]. The study sample included patients who were 18 years or older, had been receiving dialysis treatment for at least six months, were literate, and had no communication barriers. Among those who met the inclusion criteria and voluntarily participated in the study, 29 patients were included in the intervention group and 29 patients in the control group, making a total of 58 patients. Due to the death of two patients in the intervention group and the inability to reach one patient from each group for the final assessment, the study was completed with a total of 54 patients.

Outcome Measures

The data for the study were collected using the "Descriptive Information Form," the "Self-Care Agency Scale," and the "Fluid Control in Hemodialysis Patients Scale."

Descriptive Information Form: The form, prepared by the researchers based on the literature [22-24,26,27], includes sociodemographic characteristics such as age, gender, marital status, and educational background, as well as clinical data such as years on hemodialysis, primary kidney disease, and the presence of comorbidities. The frequency of hemodialysis was recorded based on the number of dialysis sessions patients reported receiving per week at the pre-test and post-test assessments. Patients' body weight was also measured at both the pre-test and post-test assessments.

Self-Care Agency Scale (SCAS): Developed by Ören and Enç in 2014, the SCAS consists of 22 items and five subdimensions [31]. These subdimensions are medication use (items 1-5, 18), diet (items 8-12), hygienic care (items 15-17,19), mental state (items 20-22), and self-monitoring (items 6,7,13,14). The scale is a 3-point Likert type (0:Never, 1:Sometimes, 2:Always). Items 12, 20, 21, and 22 are reverse scored. The total scores range from 0 to 44, with higher scores indicating greater self-care agency among patients undergoing dialysis treatment [31]. In Ören and Enç's study, the Cronbach's alpha coefficient for the overall scale was 0.75 [31]. In the present study, Cronbach's alpha was calculated as 0.73 for the pre-test and 0.76 for the post-test.

Fluid Control in Hemodialysis Patients Scale (FCHPS): Developed by Cosar and Pakyuz in 2016, the FCHPS consists of 24 items and three subdimensions: knowledge (items 1-7), behavior (items 8-18), and attitude (items 19-24) [32]. The scale is a 3-point Likert type (1:Disagree, 2:Neutral, 3:Agree). Items 7,18,19,20,21,22,23, and 24 are reverse scored. Total scores range from 24 to 72, with higher scores indicating better adherence to fluid control [32]. In Cosar and Pakyuz's study, the Cronbach's alpha coefficient for the overall scale was 0.88 [32]. In this study, Cronbach's alpha was calculated as 0.77 for the pre-test and 0.79 for the post-test.

Educational Booklet: Living with Hemodialysis

The researchers prepared the educational booklet titled "*Living with Hemodialysis*" based on the literature and feedback from experts (two hemodialysis education nurses and a nephrologist). The booklet includes information about HD under three main headings: an overview of HD, self-care agency in HD, and the impact of fluid control in HD. These sections address the following topics:

An Overview of Hemodialysis: What are the functions of the kidneys? What is CKD? What are the symptoms of CKD? What are the causes of CKD? What is kidney failure, and what are its stages? What is dialysis, and why is it important? What are the complications of HD? What should HD patients pay attention to? What are the advantages of HD?

Self-Care Agency in Hemodialysis: What is self-care? Why is self-care important for patients undergoing HD? What can be done to enhance self-care agency? How does self-care agency impact daily life? Why is self-care important in HD treatment? What are the effects of self-care agency on fluid and dietary restrictions?

The Impact of Fluid Control in Hemodialysis: What is fluid control? Why is fluid restriction important in HD? What complications may arise in the absence of fluid control? What are interdialytic weight and dry weight? How can fluid restriction be adhered to? What is the relationship between self-care agency and fluid restriction?

Randomization and Prevention of Contamination

Randomization was performed at the cluster level based on dialysis session days to prevent interaction between patients during routine treatment. Before participant recruitment, dialysis session days were assigned to either the intervention or control group using a computer-generated randomization list (randomizer.org) by a researcher not involved in data collection. All eligible patients attending the same dialysis sessions were included in the same study group according to their routine dialysis schedule. To minimize contamination between groups, intervention and control sessions were conducted on different dialysis days. Educational sessions were delivered individually in a separate room after dialysis to further reduce interaction between participants from different groups.

Pilot Application

To evaluate the comprehensibility of the forms (Descriptive Information Form, SCAS, and FCHPS) and the educational booklet prepared for the study, a pilot application was conducted. This was carried out with five patients who met the sampling criteria at the

Hemodialysis Unit of Atatürk University Health Research and Application Center. The sessions took place in the patients' rooms between May 5 and 15, 2023, using a 30-minute face-to-face interview and question-answer method. Based on the pre-application results, necessary adjustments were made to clarify certain sections of the descriptive information form and the educational booklet, and the final versions were completed. Participants included in the pilot study were not included in the main study sample or statistical analysis.

Nursing Intervention

Intervention Group: Patients who agreed to participate in the study and met the inclusion criteria provided verbal and written consent after the voluntary consent form was read to them during face-to-face meetings before their HD sessions. One of the researchers conducted individual sessions with the patients, explaining the purpose of the study and the details of the educational program. Then, the scale forms were administered. Patients' body weight was measured, and the frequency of hemodialysis was recorded based on the number of dialysis sessions they reported receiving per week at the pre-test assessment. To avoid interruptions and distractions, a separate room in the dialysis unit was used for the education sessions. Each education session lasted approximately 30-45 minutes. The educational content was identical for all participants; however, session duration varied according to patients' questions and need for clarification during the education. Education was scheduled immediately after completion of the dialysis treatment and did not interfere with treatment initiation or routine clinical workflow. The timing was coordinated with the dialysis nurses to ensure that patient care and treatment sessions were not disrupted. During and after the sessions, patients' questions were addressed in the education room. Specific topics such as fluid restriction and dietary management for patients with edema, regular exercise and appropriate posture, and the importance of adhering to the prescribed hemodialysis schedule were emphasized. For patients with additional chronic illnesses (e.g., diabetes), discussions focused on nutrition programs. Psychological support was offered to those experiencing stress or fear of death, and reminders for medication schedules were provided to patients with insufficient self-care agency. To individualize care, consultations were offered, and patients were referred to specialists (e.g., dietitians, psychiatrists, and orthopedic experts) as needed. After the education, patients were asked questions to review and discuss what they had learned. The educational booklet was provided to ensure they could revisit and reinforce the information. Following the education session, patients were contacted by telephone once a week for seven weeks to maintain continuity and reinforce learning. During these calls, they were advised to keep a fluid monitoring diary. Any challenges they faced regarding HD management were discussed, and their questions were answered. Over time, patients participated more actively in the discussions, asked fewer questions, responded more quickly to the researcher's inquiries, and reported integrating the knowledge into their daily lives. The adoption and sustainability of health-promoting behaviors require allowing sufficient time for patients to internalize and practice these behaviors [33]. Therefore, eight weeks after the pre-test, the scales were re-administered, and data were collected through face-to-face interviews (Figure 2).

Control Group: Patients who agreed to participate in the study and met the inclusion criteria provided written informed consent during face-to-face meetings in the HD unit before their sessions. Following this, the measurement tools were administered. The control group received routine nursing care, including weight measurement, vital signs assessment, and monitoring of consciousness. No educational intervention was provided. The frequency of hemodialysis was recorded at pre-test and post-test assessments. Eight weeks after the initial data collection, the scale forms were re-administered to the control group through face-to-face interviews conducted by one of the researchers (FI) in the HD unit. After completing the scales, patients were provided education on HD management using the educational booklet titled "*Living with Hemodialysis*." At the end of the session, the booklet was distributed to the patients (Figure 2).

Ethical Approval

Ethical approval for the study was obtained from the Ethics Committee of Atatürk University Faculty of Nursing (date: 11.04.2023, decision number:2023-4/2). Official permission was granted by the relevant institution (E-42190979-000-2300179201). The study was registered on ClinicalTrials.gov with the identifier NTC6534476. Throughout the study, the guidelines of the Declaration of Helsinki on Human Rights were upheld.

Statistical Analysis

The data collected within the scope of the study were analyzed using SPSS (Statistical Package for the Social Sciences) version 23.0. In the analytical process: Differences in categorical sociodemographic variables between the intervention and control groups were examined using chi-square tests. Independent samples t-test or Mann-Whitney U test was applied to compare scale scores between the two groups, based on distribution characteristics. Within-group changes over time were assessed using paired samples t-test or the Wilcoxon signed-rank test. Data distribution was evaluated by examining skewness and kurtosis values. The internal reliability of the measurement tools was evaluated through Cronbach's alpha coefficients [34].

RESULTS

The distribution and comparison of the descriptive characteristics of patients in the intervention and control groups are presented in Table 1. In the intervention group, 61.5% of the patients were over the age of 51, and 53.8% were female. Most of the patients (69.2%) were married, with 53.8% having completed primary education and 42.3% being unemployed. The majority (88.5%) reported a moderate income level, and 69.2% lived with their spouse. Half of the patients (50%) had a chronic illness other than kidney failure, and the same proportion had been living with kidney disease for 1-5 years. Additionally, 76.9% had been receiving HD treatment for 1-5 years, 65.4% had not experienced an infectious disease during HD, and 80.8% had not undergone any other treatment prior to HD. Furthermore, 65.4% of the patients stated that they received help from their spouse with household tasks (Table 1).

In the control group, 50% of the patients were over the age of 51, and 64.3% were male. The majority (53.6%) were married, with 53.6% having completed primary education and 57.1% being unemployed. Most patients (82.1%) reported a moderate-income level, and 53.6% lived with their spouse. Additionally, 53.6% did not have a chronic illness other than kidney failure, while 57.1% had been living with kidney disease for six years or more. Furthermore, 64.3% had been receiving HD treatment for 1-5 years, 78.6% had not experienced an infectious disease during HD, and 71.4% had not undergone any other treatment prior to HD. Additionally, 53.6% of the patients stated that they received help from their spouse with household tasks. The chi-square analysis showed no statistically significant differences between the intervention and control groups in terms of the descriptive characteristics (Table 1).

It was determined that the pre-test mean score of SCAS for patients in the intervention group was 31.96 ± 5.50 , while the post-test mean score was 35.58 ± 4.30 . For patients in the control group, the pre-test mean SCAS score was 31.64 ± 4.49 , and the post-test mean score was 33.50 ± 4.71 . Additionally, the pre-test mean score of the FCHPS for the intervention group was 52.12 ± 5.67 , and the post-test mean score was 61.81 ± 4.47 . In the control group, the pre-test mean FCHPS score was 51.46 ± 4.58 , and the post-test mean score was 53.43 ± 4.43 (Table 2).

Within-group analyses showed that the post-test mean scores of the SCAS were significantly higher than the pre-test scores in both the intervention and control groups ($p < 0.05$). Similarly, the post-test mean scores of the FCHPS were significantly higher than the pre-test scores in both groups ($p < 0.05$). In the between-group comparisons, the intervention group had a significantly higher post-test mean score on the FCHPS than the control group ($p < 0.05$). However, no statistically significant differences were found between the intervention and control groups in the pre- or post-test mean scores of the SCAS Scale or in the pre-test mean scores of the FCHPS ($p > 0.05$) (Table 2).

Table 1. Descriptive characteristics of patients in the intervention and control groups (n=54)

Variable	Category	Groups				Test Value and p
		Intervention		Control		
		n	%	n	(%)	
Age	28-50 years old	10	38.5	14	50	x ² =0.727 p=0.394
	≥51 years	16	61.5	14	50	
Gender	Female	14	53.8	10	35.7	x ² =1.795 p=0.180
	Male	12	46.2	18	64.3	
Marital Status	Married	18	69.2	15	53.6	x ² =1.391 p=0.238
	Single	8	30.8	13	46.4	
Education Level	Primary School	14	53.8	15	53.6	x ² =0.001 p=0.984
	Secondary School and Above	12	46.2	13	46.4	
	Unemployed	11	42.3	16	57.1	
Occupation	Retired	9	34.6	6	21.4	x ² =1.454 p=0.483
	Other	6	23.1	6	21.4	
Income Level	Low	2	7.7	3	10.7	x ² =0.608 p=1.000
	Medium	23	88.5	23	82.1	
	High	1	3.8	2	7.1	
Living Situation	Spouse	18	69.2	15	53.6	x ² =1.391 p=0.238
	Other	8	30.8	13	46.4	
Presence of Other Chronic Diseases	Yes	13	50	13	46.4	x ² =0.069 p=0.793
	No	13	50	15	53.6	
Duration of Kidney Disease (years)	1-5 years	13	50	12	42.9	x ² =0.277 p=0.599
	≥ 6 years	13	50	16	57.1	

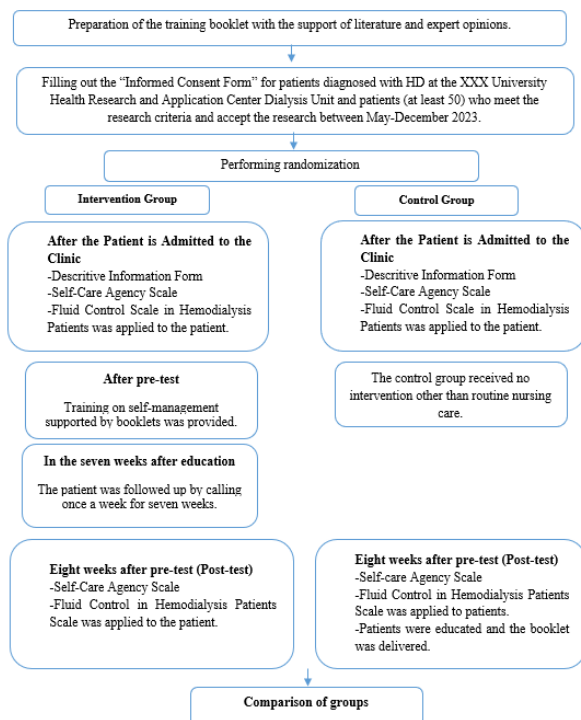


Figure 2. Study flowchart

Duration of HD	1-5 years	20	76.9	18	64.3	$\chi^2=1.033$
	≥ 6 years	6	23.1	10	35.7	$p=0.310$
History of Infectious Diseases During HD Previous Treatment Before HD	Yes	9	34.6	6	21.4	$\chi^2=1.169$
	No	17	65.4	22	78.6	$p=0.0.280$
Household Chore Assistance	Yes	5	19.2	8	28.6	$\chi^2=0.644$
	No	21	80.8	20	71.4	$p=0.422$
	Spouse	17	65.4	13	46.4	$\chi^2=1.962$
	Other	9	34.6	15	53.6	$p=0.161$

HD: Hemodialysis, χ^2 : Chi-square test statistic, df: degrees of freedom, p: significance value. $\chi^2 = \sum (O - E)^2 / E$

Table 2. Comparison of intra-group and inter-group mean scores of SCAS and FCHPS

Variable		Groups		Between-Groups Test Values and Significance ^x
		Intervention	Control	
		X $\pm$ SD	X $\pm$ SD	
SCAS	Pre-test	31.96 $\pm$ 5.50	31.64 $\pm$ 4.49	$t=-0.234$, $p=0.816$
	Post-test	35.58 $\pm$ 4.30	33.50 $\pm$ 4.71	$t=-1.709$, $p=0.093$
Within-Groups Test Values and Significance ^y		$t=-4.954$, $p=0.001$	$t=-2.372$, $p=0.025$	
FCHPS	Pre-test	52.12 $\pm$ 5.67	51.46 $\pm$ 4.58	$t=-0.466$, $p=0.643$
	Post-test	61.81 $\pm$ 4.47	53.43 $\pm$ 4.43	$t=-6.916$, $p=0.001$
Within-Groups Test Values and Significance ^y		$t=-8.079$, $p=0.001$	$t=-2.478$, $p=0.025$	

X $\pm$ SD: Mean $\pm$ Standard Deviation, SCAS: Self-Care Agency Scale, FCHPS: Fluid Control in Hemodialysis Patients Scale, t: t-test statistic, p: Significance level (p-value), x: Independent groups t-test, y: Dependent groups t-test

Regarding clinical parameters, the mean weight of patients in the intervention group decreased from 71.50 $\pm$ 16.60 before the education to 68.79 $\pm$ 14.74 after the education. In the control group, the mean weight changed from 67.68 $\pm$ 11.36 pre-education to 67.29 $\pm$ 10.98 post-education. The mean hemodialysis entry fluid levels in the intervention group decreased from 2.96 $\pm$ 0.20 to 2.62 $\pm$ 0.50 following the intervention, while in the control group the values changed from 2.96 $\pm$ 0.19 to 2.93 $\pm$ 0.26 (Table 3).

Table 3. Pre- and post-education test comparison of patients' weights and dialysis averages in the intervention and control groups

Variable		Groups		Between-Groups Test Values and Significance ^x
		Intervention	Control	
		X $\pm$ SD	X $\pm$ SD	
Weight	Pre-test	71.50 $\pm$ 16.60	67.68 $\pm$ 11.36	$t=-0.993$, $p=0.325$
	Post-test	68.79 $\pm$ 14.74	67.29 $\pm$ 10.98	$t=-0.400$, $p=0.691$
Within-Groups Test Values and Significance ^y		$t=1.788$, $p=0.086$	$t=1.364$, $p=0.184$	
Frequency of Dialysis	Pre-test	2.96 $\pm$ 0.20	2.96 $\pm$ 0.19	$t=0.052$, $p=0.958$
	Post-test	2.62 $\pm$ 0.50	2.93 $\pm$ 0.26	$t=2.868$, $p=0.007$
Within-Groups Test Values and Significance ^y		$t=3.638$, $p=0.001$	$t=1.000$, $p=0.326$	

X $\pm$ SD: Mean $\pm$ Standard Deviation, t: t-test statistic, p: Significance level (p-value), x: Independent groups t-test, y: Dependent groups t-test

When the intragroup comparisons were examined; it was determined that there was no statistically significant difference between the mean weights of the patients in the intervention group before and after the education ($p>0.05$). It was observed that the frequency of dialysis in the intervention group before the education was higher than after the education, and this difference was statistically significant ($p<0.05$). No statistically significant differences were found between the pre- and post-education weight measurements or dialysis frequency in the control group ($p>0.05$) (Table 3).

When the between-group comparisons were evaluated, no statistically significant difference was found between the intervention and control groups in terms of the pre-education frequency of hemodialysis ($p>0.05$). Following the education, however, the intervention group had a significantly lower frequency of hemodialysis than the control group ($p<0.05$) (Table 3).

DISCUSSION

It is crucial for patients receiving hemodialysis (HD) treatment to be educated about HD management to enhance their self-care agency and ensure adherence to fluid control. As self-care agency and adherence to fluid control increase, improvements are observed in disease adaptation, quality of life, well-being, and overall health perception [35,36]. Based on this premise, the findings of this study, which investigated the impact of nurse-provided education on HD self-management on self-care agency and fluid control in HD patients, revealed that the post-test mean score of the SCAS in the intervention group was significantly higher than the pre-test mean score (Table 2). The increase in post-education scale scores indicates a positive change in patients' self-care activities, demonstrating the effectiveness of the education provided. These findings are consistent with previous studies in the literature. In a study by Yıldırım and Bilgin (2022) involving 55 HD patients, education provided to address problems related to hemodialysis improved patients' self-care agency [26]. Similarly, in a study by Ren et al. (2021) with 80 HD patients, a significant increase was observed in the self-care agency post-test scores of the group that received self-management education [27]. Likewise, in a study conducted by Ramezani et al. (2019) with 70 HD patients, significant improvements in patients' self-care behaviors were observed after education based on self-efficacy theory [25]. The education supported the adoption of healthy behaviors by the patients and helped them reach a level of competence where they could contribute to further improvements. The similarity of the findings with previous studies may be related to the behavioral nature of self-care agency. Education not only provides knowledge but also increases patients' awareness and confidence in managing their condition, promoting a shift from passive care dependence to active self-management. Differences between studies may be associated with variations in education duration, follow-up period, and the level of individual support provided.

HD patients often experience difficulties with fluid restriction due to reduced self-care agency and a loss of competence [26]. The success of hemodialysis largely depends on adherence to the recommended treatment regimen and compliance with fluid restrictions. To improve adherence and ensure commitment, patients' knowledge about disease management needs to be enhanced [23]. The findings of this study support this body of literature. The education provided was found to improve patients' adherence to the treatment regimen and, consequently, their compliance with fluid restriction. It was observed that the post-test mean score of the Fluid Control in Hemodialysis Patients Scale (FCHPS) in the intervention group was significantly higher compared to the pre-test mean score, and this difference was statistically significant. Moreover, the intervention group's post-test mean FCHPS score was higher than that of the control group, and this difference was also statistically significant (Table 2). Similarly, Özdemir and Ünsar (2021) demonstrated in their study involving 107 HD patients that education based on the Roy Adaptation Model improved patients' adherence to fluid control [37]. In another study by Nadri et al. (2020), education on adherence to dietary measures and fluid restriction provided to 50 HD patients led to an improvement in fluid control levels [24]. Likewise, Başer and Mollaoğlu (2019) found that education on adherence to diet and fluid restriction given to 80 HD patients contributed positively to patients' fluid control [22]. These findings suggest that education provided to HD patients supports their adherence to fluid control. The similarity of the findings with previous studies may be related to the behavioral nature of self-care agency. Education not only provides knowledge but also increases patients' awareness and confidence in managing their condition, promoting a

shift from passive care dependence to active self-management. Differences between studies may be associated with variations in education duration, follow-up period, and the level of individual support provided.

It was found that the frequency of dialysis for patients in the intervention group was higher before the education compared to after the education, and this difference was statistically significant (Table 3). The self-care agency and fluid control of the intervention group significantly improved in the post-test. It has been demonstrated that compliance with fluid restriction positively impacts various parameters [29]. By improving fluid control, education may contribute to better management of the hemodialysis treatment process. A correlation has been reported between self-care levels, treatment adherence, and a reduction in physical and psychological symptoms among HD patients [18]. This study also provided evidence regarding the effect of increased self-care agency and improved compliance with fluid control on the treatment process. In the process of adopting health-promoting behaviors, it is crucial to allow individuals sufficient time to embrace and sustain these behaviors [33]. To determine the persistence of the desired behavior changes over time, patients undergoing hemodialysis were followed for eight weeks after the pre-test and were re-evaluated at the end of this period. It can be considered that monitoring patients' treatment adherence over a specific period and maintaining records of their daily fluid tracking influenced the retention of the education's impact. All these factors contributed to the adoption, acquisition, and maintenance of health behaviors. The reduction in the frequency of hemodialysis may indicate that the observed behavioral changes were reflected in the treatment process. This finding suggests that improvements in self-care agency may contribute to better management of the hemodialysis treatment process. The observed effect may be associated with patients' active participation in fluid monitoring and sustained behavioral reinforcement during the follow-up period. Hence, education should be considered not merely an informative intervention but a behavioral management strategy in hemodialysis care.

Limitations

This study has two primary limitations. First, it was conducted in a single hemodialysis center, which may limit the generalizability of the findings to different clinical settings or patient populations. Additionally, the follow-up period was relatively short, preventing an evaluation of the long-term sustainability of improvements in self-care agency and fluid control behaviors.

CONCLUSION

This study revealed the positive effects of education on HD management in improving self-care agency and fluid restriction knowledge among HD patients. The findings can assist nurses in designing educational intervention programs tailored to the needs and abilities of patients, within the scope of their educational role. According to the study results, education is effective in enhancing patients' self-care skills. Hence, it is crucial to encourage the broader use of personalized education programs in nursing practices, designed according to each patient's needs and learning pace. Education programs should not be regarded as one-time interventions but rather as continuous and recurring processes. Further research is needed on the long-term effects of education provided to hemodialysis patients. Nurses should regularly monitor the implementation of what patients have learned and update the education when necessary. More comprehensive courses on patient education should be incorporated into nursing education curricula. Students should be equipped with greater knowledge and skills regarding effective teaching methods, communication skills, and the development of educational materials.

Ethical Approval: 2023/4-2 Atatürk University Faculty of Nursing Ethics Committee

Conflict of Interest: The authors have no conflicts of interest to declare.

Funding: None.

Acknowledgements: None.

Author Contribution: Concept: MK, ZY; Design: MK, ZY; Data collecting: ZY, Fİ; Statistical analysis: ZY, Fİ; Literature review: ZY, Fİ; Writing: ZY, Fİ; Critical review: MK.

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