ORIGINAL

The Journal of Palembang Nursing Studies
https://jpns-journal.com/index.php/jpns
OPEN ACCESS

Fluid restriction adherence in hemodialysis patients using the ESRD-AQ: A multicenter study

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Volume 4(1), 41-50

http://dx.doi.org/10.55048/jpns155

e-ISSN 2827-8100
p-ISSN 2827-8496

Received : August 11, 2024
Revised : December 22, 2024
Accepted : January 6, 2025
Published: January 15, 2025

ABSTRACT

Background: Patients with chronic kidney disease (CKD) undergoing hemodialysis must adhere to fluid intake restrictions to prevent fluid accumulation, which can lead to complications such as edema, hypertension, and cardiovascular events. Excess intravascular and interstitial fluid volume contributes to fluid overload, a major risk factor for morbidity and mortality in this population.
Objective: To describe adherence to fluid restriction among CKD patients receiving hemodialysis and identify common barriers to adherence.
Methods: This descriptive survey study was conducted from January to June 2021 at two hospitals. A total of 129 CKD patients undergoing hemodialysis were recruited through purposive sampling. Inclusion criteria were age ≥18 years, receiving routine hemodialysis for at least 3 months, and ability to communicate verbally. Fluid restriction adherence was assessed using the End-Stage Renal Disease Adherence Questionnaire (ESRD-AQ), previously validated and culturally adapted. Descriptive statistics summarized adherence patterns and patient characteristics.
Results: Most participants were male, in late adulthood, had completed college, were unemployed, had been on hemodialysis for approximately 5 years, and underwent treatment twice weekly. Overall, 66% adhered to fluid restrictions, with 36.4% reporting following restrictions all the time. However, 62.8% indicated barriers to adherence, including lack of interest, inability to control fluid intake, and not understanding how to follow the restriction.
Conclusion: While most CKD patients complied with fluid restrictions, a substantial proportion faced challenges that could undermine long-term outcomes. Continuous education, motivational support, and individualized counseling are essential to improve adherence. Future research should explore the association between adherence, fluid overload, and clinical outcomes.

Keywords: Adherence; fluid restriction; hemodialysis; chronic kidney disease

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Nursing and Healthcare Practices

- *Nurses play a crucial role in providing ongoing education and motivational support to CKD patients undergoing hemodialysis to improve understanding and adherence to fluid restriction guidelines.*
- *Healthcare providers should routinely assess patients' compliance with fluid restrictions and monitor signs of fluid overload to prevent potential complications and hospital readmissions.*
- *Developing personalized fluid management strategies based on patients' understanding, physical condition, and psychosocial factors can enhance adherence and overall hemodialysis outcomes.*

INTRODUCTION

According to the World Health Organization, chronic kidney disease (CKD) is one of the leading causes of death worldwide. CKD is characterized by structural and functional kidney abnormalities that persist for three months or longer, ultimately becoming irreversible. These changes impair the kidneys' ability to maintain fluid and electrolyte balance (Black & Hawk, 2014; Smeltzer et al., 2010). The prevalence of CKD continues to rise globally, including in Indonesia. The National Renal Foundation estimates that 10% of the global population is affected by CKD, with approximately 2 million patients receiving kidney replacement therapy. In Indonesia, the prevalence of CKD increased by 3.8% in 2018, affecting both new and existing patients. Notably, 92% of patients undergoing hemodialysis had a primary diagnosis of stage V CKD (PERNEFRI, 2018; RISKESDAS, 2018).

Renal replacement therapy for CKD includes hemodialysis, kidney transplantation, and continuous ambulatory peritoneal dialysis (CAPD). Regardless of the modality, patients are advised to follow fluid and dietary restrictions to prevent complications. Hemodialysis aims to restore fluid balance by optimizing the composition of body fluids. However, excess fluid accumulation may result not only from excessive fluid intake but also from consumption of foods with high water content. Adhering to fluid restriction is challenging for many patients, particularly those taking medications that cause dryness of the mucous membranes as a side effect. For instance, diuretics can induce thirst, prompting increased fluid intake (Suzanne C. Smeltzer & Brenda G. Bare, 2013). Previous studies have reported suboptimal adherence to fluid restriction. Melianna and Wiarsih (2019) found that 53.6% of patients experienced fluid overload and 76% did not comply with fluid restriction recommendations. Similarly, Beerappa and Chandrababu (2019) reported an adherence rate of only 51.6% among hemodialysis patients.

In addition to poor adherence to fluid restriction, a common problem among CKD patients undergoing hemodialysis is fluid overload, characterized by an increase in intravascular and interstitial fluid volume due to excessive intake and/or fluid retention (Hung et al., 2015; Daugirdas, 2011; Tim Pokja SDKI DPP PPNI, 2016). In nursing practice, fluid overload is diagnosed based on the NANDA classification, which identifies significant associations with clinical signs such as anxiety, pulmonary congestion, jugular venous distention, edema, electrolyte imbalance, rapid weight gain, intake exceeding output, and adventitious breath sounds (Fernandes et al., 2017). Chronic fluid overload in end-stage renal disease (ESRD) has been recognized as a strong risk factor for mortality across various blood pressure categories. However, it remains unclear whether treatment strategies that incorporate routine monitoring of fluid status offer greater benefits than those relying solely on predialysis blood pressure measurements, underscoring the need for further clinical trials (Zoccali et al., 2017). Previous studies have shown wide variation in fluid restriction adherence among CKD patients undergoing hemodialysis. Most have assessed adherence indirectly through interdialytic weight gain. However, this method does not capture patients' perceptions, understanding, and self-reported behaviors related to fluid restriction. Therefore, further research is needed to explore fluid restriction adherence in relation to patient characteristics and demographics using validated self-report tools. In the present study, adherence was measured using the End-Stage Renal Disease Adherence Questionnaire (ESRD-AQ), which provides a comprehensive

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assessment of patient-reported fluid restriction behaviors. The objective was to describe fluid restriction adherence among CKD patients receiving chronic hemodialysis.

METHODS

Design

This study employed a descriptive survey design, which was deemed appropriate for obtaining a comprehensive snapshot of adherence to fluid restriction among patients with end-stage renal disease (ESRD) undergoing hemodialysis. The design allowed data to be collected within a relatively short period, at a predetermined point in time, enabling the researchers to describe patterns of adherence and identify potential trends or issues without manipulating variables. This approach is particularly suitable for exploring current practices, patient behaviors, and self-reported challenges related to fluid restriction in a real-world clinical setting.

Sample and setting

The study population consisted of 174 patients with chronic kidney disease (CKD) who were undergoing hemodialysis. A purposive sampling technique was applied to recruit participants who met specific inclusion criteria aligned with the research objectives, ensuring that the sample was representative of the target population for this study. The research was conducted at two hospitals in Semarang, Central Java, Indonesia, both of which provide routine hemodialysis services. From the eligible population, 129 patients met all inclusion criteria and agreed to participate after providing informed consent. This sample size was considered adequate to capture variability in adherence behaviors while maintaining feasibility within the study's time frame and resources.

Variable

The primary variable measured in this study was adherence to fluid restriction among patients with CKD undergoing hemodialysis. Adherence was assessed as a behavioral outcome reflecting the extent to which patients followed recommended limits on fluid intake. In addition, several demographic and clinical characteristics of respondents were recorded as potential descriptive or explanatory variables. These included gender, age, highest level of education attained, employment status, duration of hemodialysis treatment, and frequency of hemodialysis sessions per week. Collecting these characteristics allowed for a more comprehensive description of the study population and facilitated exploration of possible patterns or differences in adherence across subgroups.

Instrument

Data were collected using a structured questionnaire administered directly to respondents. The instrument was adapted from the End-Stage Renal Disease Adherence Questionnaire (ESRD-AQ) developed by Kim et al. (2010) to assess adherence to fluid restriction. For this study, only the sub-section on fluid restriction, comprising 10 items, was utilized. The ESRD-AQ has been validated in previous research, with the fluid restriction subscale demonstrating strong content validity, as indicated by an Item-level Content Validity Index (I-CVI) of 0.86 (Kim et al., 2017). The questionnaire was translated into Indonesian by a professional translator and subsequently back-translated into English by a medical-surgical nursing specialist to ensure linguistic and conceptual equivalence. Face validity was assessed with five hemodialysis patients to confirm clarity, comprehension, and cultural relevance of the items. Additionally, expert validation was conducted by a senior dialysis nurse and a nurse specialist, who confirmed the instrument's feasibility for use in this context. Minor modifications were made based on their recommendations to enhance clarity and appropriateness for the target population.

Data Collection

Data collection was conducted from January to June 2021. All participants met the predetermined inclusion and exclusion criteria. The inclusion criteria were: (1) diagnosis of CKD, (2) age ≥18 years, (3) undergoing routine hemodialysis for at least 3 months, (4) fully conscious, (5) able to communicate verbally, and (6) cooperative during the interview process. Exclusion criteria were applied to eliminate individuals who might be unable to participate fully due to cognitive impairment, emotional or situational distress, severe nausea, dizziness, or decreased consciousness.

Data collection was carried out directly by the researcher to ensure consistency, quality, and accuracy, without the involvement of enumerators. The ESRD-AQ questionnaire was

Table 1. Respondent's demographic characteristics and adherent status (n=129)

Categories	Frequency Percentage (%)				P value
	Adherence		Nonadherence		
Gender					
Man	53	(24.0)	26	(41.0)	0.555
Woman	31	(15.0)	19	(20.0)	
Age					
17-25 y.o	1	(0.8)	0	(0.0)	
26-35 y.o	3	(2.3)	4	(3.1)	
36-45 y.o	15	(11.6)	6	(4.7)	0.637
46-55 y.o	32	(24.8)	16	(12.4)	
56-65 y.o	33	(25.6)	19	(14.7)	
Level of education					
No school	6	(4.7)	3	(2.3)	
Elementary	11	(8.5)	8	(6.2)	
Junior High School	12	(9.3)	4	(3.1)	0.330
Senior High School	28	(21.7)	9	(7.0)	
College	27	(20.9)	21	(16.3)	
Employment					
Employed	23	(17.8)	14	(10.9)	0.655
Unemployed	61	(47.3)	31	(47.3)	
Length of Hemodialysis					
≤ 12 months	37	(28.7)	18	(14.0)	0.658
>12 months	47	(36.4)	27	(20.9)	
Hemodialysis Frequent					
1 time/week	0	(0.0)	2	(1.6)	0.120α
2 times/week	84	(65.1)	43	(33.3)	

Note: y.o= years old,; bivariate analysis= chi square test; α = fisher exact test

Tabel 2. Data for fluid restriction adherence on ckd-hd patients (n=129)

	Mean	Median	Min-Max	SD
Fluid Restriction Adherence	142.64	150.0	0 - 200	55.23

administered in the hemodialysis room while patients were receiving treatment. To optimize patient comfort and minimize interference with clinical procedures, the questionnaire was distributed a few moments after the vascular access had been connected to the dialysis machine by the nurse, when the patient was in a relaxed and stable condition. The researcher explained each question clearly to ensure understanding and to address any doubts, thereby reducing potential response bias. Respondents then independently completed the ESRD-AQ questionnaire sheet, providing self-reported data on their fluid restriction adherence.

Data analysis

The characteristics of respondents were summarized using descriptive statistics, with frequencies and percentages reported for all categorical variables. The relationship between demographic characteristics and adherence to fluid restriction was examined using bivariate correlation analysis. Adherence to fluid restriction was assessed based on responses to the ESRD-AQ fluid restriction subscale and described using frequency and percentage distributions. To categorize participants, the

median adherence score (142) from the study sample was used as the cut-off point, classifying respondents into two groups: adherence (scores ≥142) and non-adherence (scores <142).

Ethical consideration

Ethical approval for this research was issued from the Faculty of Medicine, Diponegoro University (No.171/EC/KEPK/FK-UNDIP/V/2021) and Roemani Muhammadiyah Hospital (No: EA-004/KEPK-RSR/I2021). Each respondent gave informed consent prior to participating in this study. The rights of participants (e.g., to participate freely and can withdraw at any time) are explained, and the confidentiality of research data is also informed. The data is stored on the computer and can be accessed by the author using a password.

RESULTS

Table 1 shows that most CKD patients receiving hemodialysis were male, in the late adulthood age group, had completed

Table 3. Distribution of fluid restriction adherence (n=129)

Fluid Restriction Adherence	Frequency	Percentage (%)
Adherence	84	65
Non-adherence	45	35

Tabel 4. Summary of respondent's fluid restriction by ESRD-AQ

Question Number	#Section 4: Fluid Restriction (10 items)		n	%
29	When was the last time a medical professional (your doctor, nurse or dietician or other medical staff) spoke to you about your fluid restrictions?	Last week	2	1.6
		One month ago	22	17.1
		More than a month ago	15	11.6
		This week	11	8.5
		When I began dialysis treatment	54	41.9
		Never	25	19.4
30	How often does a medical professional (your doctor, nurse, dietician, or other medical staff) talk to you about the importance of fluid restriction?	Every dialysis treatment	7	5.4
		Every week	5	3.9
		Every month	42	32.6
		Every 2 to 3 months	8	62
		Every 4 to 6 months	13	10.1
		When I have abnormal blood or other (for example, blood pressure) test results	18	14.0
		Rarely/irregularly/ never	36	27.9
31	During the past week, how often have you followed the fluid restriction recommendations?	All of the time	47	36.4
		Most of the time	37	28.7
		About half of the time	26	20.2
		Very seldom	17	13.2
		None of the time	2	1.6

32	How important do you think it is to limit your fluid intake?	Highly important	75	58.1
		Very important	36	27.9
		Moderately important	11	8.5
		A little important	4	3.1
		Not important	3	2.3
33	Why do you think it is important for you to limit your fluid intake? (Please choose one best answer that applies to you.)	Because I fully understand that my kidney condition requires limiting fluid intake	13	10.1
		Because limiting fluid intake is important to keep my body healthy	46	35.7
		Because a medical professional (my doctor, nurse, dietician, or other medical staff) told me to do so	33	25.6
		Because I got sick after I drank lots of fluid	26	20.2
		Because I was hospitalized after I drank lots of fluid	7	5.4
		I don't think limiting fluid is very important to me	4	3.1
34	Have you had any difficulty with limiting your fluid intake?	No	72	55.8
		Yes	57	44.2
35	How much difficulty have you had following your fluid restriction recommendations?	No difficulty	32	24.8
		A little difficulty	50	38.8
		Moderate difficulty	28	21.7
		A lot of difficulty	11	8.5
		I was unable to follow any recommendations at all	8	6.2
36	If you had difficulty following your fluid restriction recommendations, what type of difficulty have you had?	No difficulty	43	33.3
		Not interested	35	27.1
		I was unable to control fluid intake	17	13.2
		I don't understand how to follow the fluid restriction	29	22.5
		Other	5	3.9
37	During the past week, how many times have you weighed yourself at home (outside dialysis center)?	More than 3 times	38	29.5
		3 times	4	3.1
		Twice	48	37.2
		Once	9	7.0
		None of the time	30	23.3

college, were unemployed, had been on hemodialysis for approximately 5 years, and typically underwent treatment twice per week. No statistically significant associations were found between fluid restriction adherence and patient characteristics, including gender, age, education level, employment status, and length or frequency of hemodialysis ($p > 0.005$).

The mean adherence score was 142.64, indicating that higher scores on the ESRD-AQ reflected greater compliance with fluid restriction (Table 2).

According to Table 3, the majority of respondents (84 participants, 66%) adhered to fluid restriction guidelines, while 45 participants (34%) were classified as non-adherent.

Table 4 summarizes patients' perceptions of fluid restriction based on ESRD-AQ responses. Most medical professionals discussed fluid restriction with patients at the start of treatment, with subsequent discussions on its importance typically occurring on a monthly basis. A total of 36.4% of respondents reported following fluid restriction "all the time," while 58.1% and 27.9% rated fluid restriction as "highly important" and "very important," respectively. In terms of challenges, 44.2% reported some difficulty adhering to fluid limits, whereas 55.8% indicated no difficulty. Reported challenges ranged from "unable to follow" to "no difficulty," with 33.3% citing no difficulty at all. However, 62.8% indicated barriers such as lack of interest, inability to control fluid intake, or not understanding how to follow the restriction. Self-monitoring practices were also suboptimal; many respondents did not weigh themselves more than three times per week at home. Regarding the importance of daily weight measurement, 65.7% considered it highly or very important, while the remainder rated it as moderately important, slightly important, or not important. These findings suggest that although patients generally acknowledge the importance of fluid restriction and weight monitoring, a substantial proportion face practical and motivational barriers that may hinder consistent adherence.

DISCUSSION

Consistent with several previous studies, the present study found no significant association between demographic characteristics—such as age, gender, employment status, length of hemodialysis treatment, and education level—and adherence to fluid restriction. Among the 129 respondents, 66% were classified as adherent to fluid restriction, while 34% were non-adherent. These findings align with the results of Alawiyah and Edison (2018), who reported a 61% adherence rate among CKD patients, and with Novitasari (2014), who found that 71.7% of respondents adhered to fluid restriction while 28.3% did not. However, the current findings differ from those of Beerappa (2019), who reported a much lower adherence rate of 28.3%, with the majority of respondents (71%) failing to comply with fluid restriction recommendations. Similarly, Melianna and Wiarsih (2019) reported that 68% of patients were non-adherent, with only 32% meeting adherence criteria. These variations across studies may reflect differences in patient populations, measurement tools, adherence definitions, and contextual factors such as health education delivery, social support, and healthcare system resources.

Patients with CKD undergoing hemodialysis are advised to restrict their daily fluid intake to prevent fluid overload and related complications. Adherence, in this context, refers to the extent to which individuals follow prescribed medical regimens, including medication use, dietary restrictions, and lifestyle modifications, in accordance with recommendations from healthcare providers (Bradero Mary, 2009). Compliance with fluid restriction specifically reflects the patient's ability to regulate fluid consumption in line with clinical guidelines. For hemodialysis patients, a commonly applied standard is to limit fluid intake to 500 mL per day plus the volume of urine produced in the previous 24 hours. This guideline aims to minimize interdialytic weight gain, reduce the risk of hypertension and cardiovascular strain, and improve overall treatment outcomes.

High levels of compliance with fluid restriction may be influenced by multiple factors. The determinants such as gender, educational attainment, knowledge level, duration of hemodialysis treatment, heat exposure, availability of support, and interdialytic weight gain (IDWG). Other studies have categorized these determinants into broader domains, including patient-related factors (e.g., age, gender, educational level, knowledge, and interpersonal communication), socioeconomic factors (e.g., income, employment status, social and family support, and peer support), psychological factors, healthcare system–related factors, therapy-related factors, and disease-related factors (Chironda & Bhengu,

2016). Variations in these factors across different patient populations and healthcare settings may explain why the findings of this study align with some previous research while differing from others. Differences in cultural context, patient education strategies, and availability of support systems could also contribute to these discrepancies.

Findings from this study, based on the ESRD-AQ responses, indicate that most medical professionals discussed fluid restriction with patients at the start of hemodialysis treatment, with follow-up discussions on its importance typically occurring on a monthly basis. A substantial proportion of respondents reported following fluid restriction "all the time" and rated its importance as "highly important" or "very important." However, some patients acknowledged experiencing difficulty in adhering to fluid limits, despite the majority reporting no such challenges. These difficulties persisted even among patients who had received education on the importance of fluid restriction, suggesting that knowledge alone may be insufficient to ensure consistent adherence. Sustained compliance appears to require not only adequate knowledge but also strong motivation and self-regulation skills. Barriers to full adherence may stem from environmental factors (e.g., high temperatures and limited access to low-fluid foods), social influences (e.g., family eating habits), and psychological conditions (e.g., stress, depression, or low self-efficacy), all of which can undermine patients' ability to maintain fluid restriction over time.

The degree of difficulty in following fluid restriction among respondents ranged from "unable to follow" to "no difficulty." While a portion of participants reported no challenges, 62.8% indicated barriers such as lack of interest, inability to control fluid intake, or not understanding how to follow the restriction. In terms of self-monitoring, many respondents did not weigh themselves more than three times per week, despite recommendations for daily weight monitoring. Perceptions of the importance of daily weighing varied, with 65.7% rating it as highly or very important, and the remainder considering it moderately, slightly, or not important. Non-adherence to fluid restriction places patients at risk for complications such as fluid overload, which can lead to edema, dyspnea, cardiovascular strain, and excessive weight gain (Beaubien-Souligny et al., 2018; Czyżewski et al., 2017; Hao et al., 2018; Koc et al., 2011; Santos et al., 2015). Preventing fluid overload is therefore critical to avoiding deterioration in patient condition and reducing hospitalizations. Beyond clinical education, strategies to maintain patients' knowledge, motivation, and self-efficacy are essential. Evidence suggests that structured and continuous education models—particularly those incorporating personalized counseling and motivational support—can significantly improve adherence to fluid restriction in hemodialysis patients (Başer & Mollaoğlu, 2019; Nadri et al., 2020).

Implication and Limitations

This study found the adherence of Chronic Kidney Disease – Hemodialysis (CKD-HD) patients to fluid restriction is very relevant to the condition of CKD-HD patients, who have a high risk of experiencing body fluid overload due to failure of their kidney function. The results show that demographic characteristics cannot always be reported as related to adherence to this fluid restriction. This can be due to the compliance of CKD-HD patients in restricting fluid, which can be influenced by many factors. Results show that demographic characteristics cannot play a role alone in building a person's adherence to therapy. Self-management to weigh daily is still not carried out routinely, and patients do not understand the importance of weighing daily. Some of the implications are the following: (1) The provision of health education is not only when the patient is diagnosed and must undergo dialysis therapy, but can be given on an ongoing basis; (2) health education, accompanied by assistance by health workers to patients, will increase patient mutual trust in nurses and willingness to help if there are physical or psychological problems for patients who need coaching; (3) patients need to be given motivation and psychological reinforcement from care givers, both nurses and families in particular, about fluid restriction; (4) it is important for nurses to understand the difficulties experienced by patients in fluid restriction; and (5) health service policies in providing easy access for patients to openly obtain information about ways and techniques to limit fluids. There are some limitations to this research. First, researchers used only two hospitals in the Semarang area in this study, so they cannot provide a broader evaluation for the Indonesian region, which has many islands. It is recommended for further research to add samples from more hospitals or dialysis

centers that can represent various regions in Indonesia. Second, this study has not been able to provide further descriptions, related to the results showing that there are still many patients who do not understand how to limit fluids, so it is recommended that further research can add information related to the knowledge, attitudes, and behavior of patients in fluid restriction.

CONCLUSION

The characteristic of CKD patients undergoing hemodialysis in this study, among others, are male with an age range of 46-59 years including in the late adult age group, most of the latest education was a university, most of them are not working, with the duration of hemodialysis is 1-5 years at most, most of the frequency of hemodialysis in one week is 2 times. The Fluid restriction adherence in patients with chronic kidney disease undergoing hemodialysis revealed that most respondents. Some of the respondents followed fluid restriction "all the time", but almost respondents stated, "not interest", "unable to control", and "I don't understand how to follow the fluid restriction" (62.8% totally). CKD patients are expected to be able to maintain and improve compliance with fluid restriction. CKD patients can also prevent fluid overload, one of which is by maintaining fluid intake. Families provide support for patients in controlling fluid restrictions. For nursing services, especially hemodialysis nurses can improve services to patients both preventively and promotively, for example by providing education on the importance of fluid restriction and fluid overload checks. For further researchers, it is hoped that this study can develop both quantitative and qualitative research on the level of adherence to fluid restriction and the incidence of fluid overload in CKD patients undergoing hemodialysis, such as factors related to the compliance of fluid restrictions and factors related to fluid overload.

Declaration of Interest

The authors declare that no conflicts of interest exist.

Acknowledgment

Authors can be contacted to access datasets created for and/or used in this study.

Funding

None

Data Availability

None

REFERENCES

Alawiyah, S. K., & Edison, C. (2018). Adherence to dialysis therapy management in hemodialysis patients. *UI Proceedings on Health and Medicine, 3*, 38–41. http://proceedings.ui.ac.id/index.php/uiphm/article/view/39

Başer, E., & Mollaoğlu, M. (2019). The effect of a hemodialysis patient education program on fluid control and dietary compliance. *Hemodialysis International, 23*(3), 392–401. https://doi.org/10.1111/hdi.12744

Beaubien-Souligny, W., Rhéaume, M., Blondin, M.-C., El-Barnachawy, S., Fortier, A., Éthier, J., Legault, L., & Denault, A. Y. (2018). A Simplified Approach to Extravascular Lung Water Assessment Using Point-of-Care Ultrasound in Patients with End-Stage Chronic Renal Failure Undergoing Hemodialysis. *Blood Purification, 45*(1–3), 79–87. https://doi.org/10.1159/000481768

Beerappa, H., & Chandrababu, R. (2019). Adherence to dietary and fluid restrictions among patients undergoing hemodialysis: An observational study. *Clinical Epidemiology and Global Health, 7*(1), 127–130. https://doi.org/10.1016/j.cegh.2018.05.003

Black, J. M., & Hawk, J. H. (2014). *Buku keperawatan medical bedah: Manajemen klinis untuk hasil yang diharapkan-buku 2* (Edisi Bahasa Indonesia) (A. Suslia, F. Ganiajri, P. P. Lestari, & R. W. A. Sari, Eds.; 8th ed., Vol. 2). Penerbit Salemba Medika.

Czyżewski, Ł., Wyzgał, J., Czyżewska, E., Sierdziński, J., & Szarpak, Ł. (2017). Contribution of volume overload to the arterial stiffness of hemodialysis patients. *Renal Failure, 39*(1), 333–339. https://doi.org/10.1080/0886022X.2017.1279552

Daugirdas, J. T. (2011). *Handbook of Chronic Kidney Disease Management.* Wolters Kluwer.

Fernandes, M. I. da C. D., Enders, B. C., & Lira, A. L. B. de C. (2017). Analyzing the concept of fluid overload in Chronic Kidney Disease patients in dialysis therapy: An integrative review. *Revista Da Escola de Enfermagem, 51*, 1–9. https://doi.org/10.1590/S1980-220X2016036003299

Hao, G., Lu, W., Huang, J., Ding, W., Wang,

P., Wang, L., Ding, F., Hu, M., & Hou, L. (2018). Predialysis fluid overload linked with quality of sleep in patients undergoing hemodialysis. *Sleep Medicine, 51*, 140–147. https://doi.org/10.1016/j.sleep.2018.07.011

Hung, S., Lai, Y., Kuo, K., & Tarng, D. (2015). Volume Overload and Adverse Outcomes in Chronic Kidney Disease: Clinical Observational and Animal Studies. *Journal of the American Heart Association, 4*(5). https://doi.org/10.1161/JAHA.115.001918

Kim, I. Y., Kim, J. H., Lee, D. W., Lee, S. B., Rhee, H., Seong, E. Y., Kwak, I. S., & Song, S. H. (2017). Fluid overload and survival in critically ill patients with acute kidney injury receiving continuous renal replacement therapy. *PLOS ONE, 12*(2), e0172137. https://doi.org/10.1371/journal.pone.0172137

Kim, Y., Evangelista, L. S., Phillips, L. R., Pavlish, C., & Kopple, J. D. (2010). The End-Stage Renal Disease Adherence Questionnaire (ESRD-AQ): testing the psychometric properties in patients receiving in-center hemodialysis. *Nephrology Nursing Journal : Journal of the American Nephrology Nurses' Association, 37*(4), 377–393.

Koc, Y., Unsal, A., Kayabasi, H., Oztekin, E., Sakaci, T., Ahbap, E., Yilmaz, M., & Akgun, A. O. (2011). Impact of volume status on blood pressure and left ventricle structure in patients undergoing chronic hemodialysis. *Renal Failure, 33*(4), 377–381. https://doi.org/10.3109/0886022X.2011.565139

Melianna, R., & Wiarsih, W. (2019). Hubungan kepatuhan pembatasan cairan terhadap terjadinya overload pada pasien gagal ginjal kronik post hemodialisa di Rumah Sakit Umum Pusat Fatmawati. *JIKO (Jurnal Ilmiah Keperawatan Orthopedi), 3*(1), 37–46. https://doi.org/10.46749/jiko.v3i1.28

Nadri, A., Khanoussi, A., Hssaine, Y., Chettati, M., Fadili, W., & Laouad, I. (2020). Impact de l'éducation du patient en hémodialyse sur le respect des mesures diététiques et sur la restriction aux liquides. *Néphrologie & Thérapeutique, 16*(6), 353–358. https://doi.org/10.1016/j.nephro.2020.03.011

ACDD, N. (2014). Kepatuhan pembatasan asupan cairan terhadap lama menjalani. *J Prodi Keperawatan Univ Aisyiyah Yogyakarta, 8*(1), 104-12.

PERNEFRI. (2018). *11th report of indonesian renal registry 2018.* https://www.indonesianrenalregistry.org/data/IRR2018.pdf

RISKESDAS. (2018). *Laporan nasional riskesdas 2018.* http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan_Nasional_RKD2018_FINAL.pdf

Santos, P. R., Monteiro, D. L. S., de Paula, P. H. A., Monte Neto, V. L., Coelho, M. L. P. M., Arcanjo, C. C., Aragão, S. M. L., Gondim, C. B., Tapeti, J. T. P. C., Mendes, H. S., Vieira, L. V., & Prado, R. D. C. P. (2015). Volaemic status and dyspepsia in end-stage renal disease patients. Nephrology, 20(8), 519–522. https://doi.org/10.1111/nep.12481

Smeltzer, S. C., Bare, B. G., Hinkle, J. L., & Cheever, K. H. (2010). *Brunner and Suddarth's textbook of medical-surgical nursing* (12th ed., Vol. 1). Lippincott Williams & Wilkins.

Suzanne C. Smeltzer, & Brenda G. Bare. (2013). *Buku ajar keperawatan medikal-bedah Brunner&Suddarth* (Suzanne C. Smeltzer & Brenda G. Bare, Eds.; 8th ed., Vol. 3). EGC.

Tim Pokja SDKI DPP PPNI. (2016). Standar Diagnosis Keperawatan Indonesia (SDKI) (1st ed.). Persatuan Perawat Indonesia.

Zoccali, C., Moissl, U., Chazot, C., Mallamaci, F., Tripepi, G., Arkossy, O., Wabel, P., & Stuard, S. (2017). Chronic fluid overload and mortality in ESRD. *Journal of the American Society of Nephrology, 28*(8), 2491. https://doi.org/10.1681/ASN.2016121341