



THE EFFECTIVENESS OF INTRADIALYTIC EXERCISE ON FATIGUE LEVELS IN PATIENTS WITH CHRONIC KIDNEY DISEASE UNDERGOING HEMODIALYSIS: A SYSTEMATIC REVIEW

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ABSTRACT

Chronic Kidney Disease (CKD) is a global health problem requiring long-term renal replacement therapy, including hemodialysis. Although hemodialysis is essential for survival, patients often experience fatigue, which negatively impacts functional capacity, daily activities, and quality of life. One non-pharmacological approach to reducing fatigue is intradialytic exercise, defined as physical activity performed during hemodialysis sessions. This systematic review aimed to evaluate the effectiveness of intradialytic exercise in reducing fatigue levels in patients with chronic kidney disease undergoing hemodialysis. The systematic review was conducted using the PICO framework. Articles published between 2020 and 2025 were identified from PubMed, ScienceDirect, and Google Scholar databases. A total of 137 articles were retrieved, and inclusion criteria were selected using full-text studies with quasi-experimental designs, randomized controlled trials, or pre-experimental studies examining intradialytic exercise and fatigue outcomes in hemodialysis patients. Study selection followed PRISMA guidelines, and data were extracted based on study design, sample size, intervention type, and outcomes. Therefore, ten articles that met the inclusion criteria were used. Findings consistently demonstrate that intradialytic exercise, including flexibility, aerobic, resistance, and stretching exercises, significantly reduces fatigue levels in patients undergoing hemodialysis. Several studies also report improvements in activity tolerance and dialysis adequacy. Intradialytic exercise is an effective and safe non-pharmacological nursing intervention to reduce fatigue in CKD patients undergoing hemodialysis. Integrating intradialytic exercise into routine hemodialysis care can improve patient well-being and quality of life.

Keywords: fatigue; hemodialysis patients; intradialytic exercise

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INTRODUCTION

Chronic kidney disease (CKD) is a condition characterized by a progressive pathophysiological process in which kidney function gradually declines, rendering the body unable to maintain metabolic, fluid, and electrolyte balance, leading to uremia (Firdaus et al., 2022). Chronic kidney failure is a serious health issue. Globally, the prevalence of chronic kidney disease (CKD) has reached over 10%, quantitatively affecting more than 850 million individuals. This condition continues to increase and is projected to become the fifth leading cause of death by 2040 (Kovesdy, 2022). Meanwhile, the prevalence of CKD in Indonesia has reached over 739,000 and has reached 3.8%, representing a nearly twofold increase compared to the previous decade. This surge is reflected in BPJS Kesehatan data, which records 134,057 patients actively undergoing dialysis (Ministry of Health, 2023). Chronic kidney disease (CKD) is a condition that requires long-term renal replacement therapy, one of which is hemodialysis, due to the persistent decline in kidney function. Hemodialysis therapy aims to maintain fluid and electrolyte balance and remove metabolic waste. Despite its crucial role in maintaining survival, CKD patients undergoing hemodialysis often experience various physical and psychological complications that impact their quality of life (Herabare et al., 2023).

Fatigue is one of the clinical signs of chronic kidney disease. Fatigue can be a feeling of discomfort characterized by weakness, fatigue, and decreased energy. Patients with chronic kidney disease often experience difficulty concentrating, fatigue, sleep deprivation, emotional disturbances, and a decreased ability to perform daily activities, which can lead to a decreased quality of life (Firdaus et al., 2022). Fatigue is a common complaint among patients undergoing hemodialysis and can significantly impact their quality of life. One cause of fatigue is the long duration of hemodialysis, as patients are typically seated or lying down without much movement during the procedure. Prolonged lack of physical activity causes muscles to become inactive, which can trigger muscle atrophy, resulting in soreness and fatigue (Safruddin, a; Agung R N, Anggraini, 2025).

In this condition, fatigue can be reduced or managed through various methods, both pharmacological and non-pharmacological therapies. One such approach is intradialytic exercise. Intradialytic exercise, which is physical activity performed during hemodialysis, effectively reduces fatigue levels by improving muscle perfusion, hormonal balance, and cardiovascular function. Intradialytic exercise consists of three types: flexibility exercise, aerobic exercise, resistance exercise, ROM exercise, and stretching exercise (Muliani et al., 2021). Various studies have shown that this exercise has the potential to reduce fatigue levels by improving blood circulation, muscle function, and cardiovascular capacity. However, understanding the adaptive mechanisms of intradialytic exercise still requires a strong theoretical foundation, particularly from a nursing perspective (Lubis, 2025). The variations in findings and methodologies among these studies underscore the necessity of conducting a systematic review to assess the impact of exercise during hemodialysis on fatigue in patients with chronic kidney disease. This study aims to identify and evaluate the effectiveness of intradialytic exercise in reducing fatigue levels, and to compare different types of exercise interventions performed during hemodialysis to determine the most effective approach.

METHOD

The research design in this journal is a systematic review based on the PICO (Population, Intervention, Comparison, Outcome) guidelines. The PICO framework was applied to formulate research questions and determine article inclusion criteria, as follows:

Table 1.

PICO

PICO	Related Keywords
Population	Hemodialysis patients
Intervention	Intradialytic Exercise
Comparison	Control
Outcome	Fatigue

The sample in this study consisted of scientific articles published between 2020 and 2025. Article searches were conducted through electronic databases such as PubMed, Scencedirect, and Google Scholar. Article inclusion criteria were: a) 5-year time span; publication period: 2020 to 2025; b) Quasi-experimental research, randomized controlled trial (RCT), or pre-experimental; c) Availability of full text; d) Appropriateness to the research topic and objectives. The keywords used in the article search were "Hemodialysis patients" OR "Hemodialysis patients," AND "Intradialytic Exercise," AND "Fatigue" OR "Kelelahan," using Boolean operators to optimize the search. The article selection and screening process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram, an evidence-based guideline designed to help researchers compile and report systematic reviews in a transparent and structured manner. The PRISMA diagram involves four stages: identification, screening, eligibility, and study inclusion. Data were then extracted from the selected articles using an extraction form containing information on the study design, sample size, interventions administered, and research results.

RESULT

Based on a literature search through several databases, including PubMed, ScienceDirect, and Google Scholar, using keywords related to intradialytic exercise, hemodialysis, and fatigue, 197 articles were obtained. The search results consisted of 30 articles from PubMed, 40 articles from ScienceDirect, and 127 articles from Google Scholar.

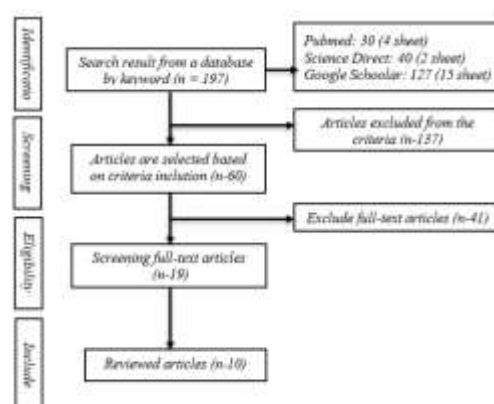


Figure 1. PRISMA Flowchart

In the identification stage, all obtained articles were then screened based on the suitability of the title, abstract, and established inclusion criteria. At this stage, 137 articles were excluded due to inappropriateness to the research topic, leaving 60 articles that met the initial criteria. Next, in the screening stage, an assessment was conducted on the availability and suitability of full-text articles. Of these 60 articles, 41 were excluded due to unavailability of full-text articles or failure to meet the research criteria, leaving 19 articles for further assessment. In the eligibility stage, the 19 full-text articles were analyzed in more depth based on the suitability of the study design, population, intervention, and results. After the final selection process, 10 articles met the inclusion criteria and were used in the analysis of this literature review. The article selection process is presented in a PRISMA flowchart, depicting the stages of identification, screening, eligibility, and inclusion, leading to the articles analyzed in this study.

Table 2.
Article Search Results

Title	Author / Year / Place	Research purposes	Research methods	Sample	Instrument Study	Research result
The Effect of Intradialytic Range of Motion Exercise on Dialysis Adequacy and Fatigue in Hemodialysis Patients	Malini H., Forwaty E., Cleary M., Visentin D., Oktarina E., Lenggogeni DP (2022), In the Hemodialysis Room of the General Hospital, West Sumatra-Indonesia	For determine influence exercise range movement intradialytic to adequacy dialysis and fatigue in patients undergoing hemodialysis.	Randomized Controlled Trial (RCT) with intervention and control.	50 respondents (23 groups) intervention, 24 control groups)	Fatigue Assessment Scale (FAS), Kt/V and Urea Reduction Ratio (URR) measurements	Group intervention experience improvement significant Kt/V and URR as well as decreased fatigue after 8 weeks (p < 0.001), whereas group control No show repair meaningful
The Effect of Intradialytic Exercise on Fatigue Related Chronic Kidney Disease: A Case Study of Patients Undergoing Hemodialysis	Bastari Dwi Kurniawati, Tatik Dwi Wahyuni Anggi Lukman Wicaksana. 2022. Dr. Sardjito General Hospital	For explore i exercise intradialytically viable based on proof latest for reduce complaint fatigue in patients undergoing hemodialysis.	Case study on one patient hemodialysis	Case study on one patient man 50 years old with disease kidney chronic	Questionnaire scale FACIT fatigue and indicators clinical measured before and after intervention.	Research result show decline score fatigue patient after exercise intradialytic for 2 weeks. Previous studies also reported that exercise intradialytic effective lower

Title	Author / Year / Place	Research purposes	Research methods	Sample	Instrument Study	Research result
						fatigue and biochemical parameters in patients hemodialysis, with difference significant level fatigue before and after intervention.
The Effect of Intradialytic Aerobic Exercise on Dialysis Parameters and Fatigue in Hemodialysis Patients: A Non-Randomized Interventional Study	Lakshmi Yoga, Sasikala D, Santosh Varughese. 2024.	For evaluate effect exercise aerobics intradialytic on dialysis parameters and fatigue.	Non-randomized interventional study (experimental without randomization).	Population of 295 patients selected hemodialysis through taking sample sequentially (group control, n=147; group experimental, n=148) from two centers maintenance tertiary.	S assessment period Fatigue (FAS)	Intradialytic exercises cause improvement significant on blood urea levels, creatinine, and fatigue post -test on groups experiment (p
Effect of Intradialytic Aerobic Exercise on Fatigue in Patients Undergoing Hemodialysis	S. Yogalakshmi, Dr. Santosh Varughese, Dr. Sasikala. D. 2022. 2 centers maintenance tertiary in Chennai	For determine influence exercise aerobics intradialytic to fatigue in patients hemodialysis	Quasi-experimental with design group control and experiment.	60 HD patients (30 each in group control and experimental)	Fatigue Assessment Scale (FAS)	T there are significant difference after intervention I (t=2.58, p=0.001) and after intervention II (t=3.71, p = 0.001) between group control and experiment.
Impact of Exercise on Fatigue in Patients Undergoing Dialysis in a Tertiary Care Hospital	Vijay Samuel Raj V, Prashanth V. Mangalved, Manjunath S. Shetty, Deeya C. Balakrishnan.	For know the impact of exercise on Fatigue in Patients Undergo Dialysis	Longitudinal quasi-experimental	A total of 48 HD patients, with group A (group exercise (EG) consists of of 23 participants and group B (group control (CG)) consists of of 25 participants .	Rating Scale Fatigue (FAS)	The results show significant difference in a waystatist cs between second groups at weeks 24 and 36 (P = 0.001).
The Effectiveness of Flexibility Exercise on Fatigue Levels in Intra Hemodialysis Patients at Siti Aisyah Hospital in Lubuklinggau City	Verawati, Yenni Fusfitasar, Veby Fransisca Rozi, STIKes Bhakti Husada 2023. In the room Hemodialysis at Siti Aisyah Hospital, Lubuklinggau City.	For know the influence of Flexibility Exercise on Fatigue level in intra hemodialysis patients	Pre - experimental with one group pretest posttest design.	10 intra hemodialysis patients	FACIT Fatigue Scale	Average fatigue before intervention: 23.30 Average fatigue after intervention: 20.90 There is influence significant effect of Flexibility Exercise on fatigue (p = 0.004)
Intradialytic Exercise: Flexibility on Fatigue Score in Chronic Kidney Disease Patients Undergoing	Rizki Muliani, Asri R Muslim, Imam Abidin Bhakti Kencana University. 2021. In the room Hemodialysis	For know the effect of intradialytic exercise: flexibility on fatigue scores in patients undergoing hemodialysis.	Quasi-experimental with pretest - posttest design without group control.	20 patients who underwent hemodialysis	FACIT - Fatigue Scale	There is improvement average fatigue score from 25.70 becomes 30.75 after intervention, with p value < 0.001.

Title	Author / Year / Place	Research purposes	Research methods	Sample	Instrument Study	Research result
Hemodialysis	at Mrs. RA Habibie Kidney Specialist Hospital Bandung					
Intradialytic Flexibility Exercise on Fatigue in Patients with Chronic Kidney Disease	Anik Inayati, Wati Jumaiyah, Siti Latipah. 2025. In the room hemodialysis at Dr. H. Abdul Moeloek Regional Hospital	For know effectiveness giving intradialytic flexibility exercise intervention on decline fatigue patient disease kidney chronicle	Quasi-experimental with one group pretest-posttest approach.	15 CKD patients	FACIT Fatigue Scale	Happen improvement significant FACIT-Fatigue score from beginning until week 4 ($p < 0.05$), with effects that are progressive and sustainable
Effect of Stretching Exercises Between Dialysis Periods on Fatigue Scores in Chronic Kidney Failure Patients at Ciamis District Hospital	Asep Novi Taufiq Firdaus, Agung Waluyo, Wati Jumaiyah. 2022. In the room hemodialysis at the District Hospital Ciamis	For know influence exercise physical stretching exercise between time dialysis to fatigue score.	Quasi-experimental with design group control and group intervention.	34 CKD patients, with 17 groups intervention and 17 groups control	FACIT-F (functional assessment of chronic illness therapy fatigue) questionnaire	Stretching exercise in significant lower fatigue scores in the group intervention ($p = 0.001$), control No show decline significant
Effectiveness Of Intradialytic Exercise On Fatigue In Chronic Kidney Failure Patients Undergoing Hemodialysis Therapy	Safruddin, Rizki Nugraha Agung, Dewi Anggraini, Wati Jumaiyah. 2025. in the Hemodialysis Room of Labuang Baji Hospital, Makassar City.	For evaluate influence exercise intradialytic to level fatigue in patients undergoing therapy hemodialysis.	Pre - experimental with pretest posttest design.	22 HD patients	FACIT-F (functional assessment of chronic illness therapy fatigue) questionnaire.	Fatigue intervention after is 32.09 (SD $\pm$ 4.116) with p - value 0.001, size effect -3.378, then including in category size effect according to Cohen

DISCUSSION

Fatigue is a dominant problem in hemodialysis patients, influenced by physiological factors such as the accumulation of uremic toxins, anemia, metabolic disorders, and limited physical activity during prolonged dialysis. Research (Yulianti & Ladesvita, 2021) suggests that uremic syndrome in patients undergoing hemodialysis can cause fatigue. This occurs due to peripheral nerve damage caused by uremic neuropathy, which damages nerve cells, particularly in the distal parts, as well as motor and sensory nerves. Another study (Rositasari & Maliya, 2022) explains that the accumulation of uremic toxins in hemodialysis patients can also increase the risk of restless legs syndrome, further exacerbating discomfort and fatigue. Research (Rosaulina et al., 2021) shows that intradialytic exercise performed during hemodialysis can increase blood flow to muscles. This exercise can also increase the number and width of capillaries, thereby facilitating the movement of urea and toxins from tissues to the blood vessels, which are then channeled to the dialysis machine (dialyzer) for removal. Based on the results of a review of ten reviewed journals, all studies showed that intradialytic exercise is effective in reducing fatigue levels in patients with chronic kidney disease undergoing hemodialysis. All studies applied intradialytic exercise as the primary

intervention, but with variations in duration, type of exercise, and frequency of implementation. The types of exercises used included aerobic exercise (Lakshmi et al., 2024); (Lakshmi et al., 2022), flexibility exercise (Verawati, Yenni Fusfitasari, 2023); (Muliani et al., 2021); (Inayati & Jumaiyah, 2025), stretching exercise (Firdaus et al., 2022); (Safruddin, Agung, & Anggraini, 2025); (Kurniawati et al., 2022); (Samuel Raj V et al., 2023), and range of motion exercise (Malini et al., 2022). The duration and frequency of exercise also varied, ranging from 15 minutes to over 30 minutes per session, with intervention periods ranging from 2 weeks to 12 weeks.

All interventions aimed to reduce fatigue, improve patient quality of life, enhance functional capacity, and improve dialysis parameters. Studies by (Verawati & Fusfitasari, 2023); (Muliani et al., 2021); and (Inayati & Jumaiyah, 2025) reported a significant and progressive reduction in fatigue scores through intradialytic stretching exercises, as measured using the FACIT-Fatigue Scale. Similar findings were corroborated by (Firdaus et al., 2022) and (Safruddin et al., 2025), who showed that patients who received physical exercise interventions during hemodialysis experienced a more significant reduction in fatigue compared to the control group. This suggests that exercise plays a crucial role in improving activity tolerance and preventing stiffness and decreased muscle function due to immobilisation. Meanwhile, a case study by (Kurniawati et al., 2022) and research by Lakshmi et al. (2024) and (Lakshmi et al., 2022) indicate that intradialytic aerobic exercise is safe and effective, even with varying duration and intensity.

In addition to reducing fatigue, several studies have also demonstrated additional physiological benefits of intradialytic exercise. Research by (Malini, et al., 2022) not only highlighted reduced fatigue but also found that intradialytic range-of-motion exercises can improve dialysis adequacy (Kt/V and URR). These findings support the theory that increased muscle activity during hemodialysis can improve blood flow and aid the diffusion of metabolic wastes through the dialyzer, thus positively impacting the patient's overall physical condition. Research by (Lubis, 2025) shows that intradialytic exercise not only increases muscle strength and reduces weakness but also helps address sleep disturbances in hemodialysis patients. This mechanism is influenced by changes in body temperature, cytokine concentration, metabolism, mood, heart rate, growth hormone secretion, brain-derived neurotrophic factor (BDNF) secretion, and body composition (Nurlita & Dewi, 2024). Research (Nurfitriani & Maliya, 2020) shows that fatigue is significantly associated with the quality of life of hemodialysis patients in the psychological and social domains. This is consistent with the fact that regularly performing intradialytic exercise during hemodialysis can improve patients' quality of life, promote relaxation, and facilitate sleep. Long-term research also shows that consistent exercise has a more optimal impact on reducing fatigue compared to short-term interventions. This is supported by research (Samuel Raj V et al., 2023), which showed that long-term exercise interventions have a more significant impact on reducing levels of fatigue.

CONCLUSION

Based on a literature review of ten journals, it can be concluded that intradialytic exercise is effective in reducing fatigue levels in patients with chronic kidney disease undergoing hemodialysis. Exercise performed during hemodialysis, in the form of intradialytic exercise, has been shown to significantly reduce fatigue scores. This intervention improves blood circulation, prevents muscle stiffness due to immobilization, and supports increased patient activity tolerance, thereby reducing post-hemodialysis fatigue. These findings provide a novel contribution to evidence-based nursing practice, confirming that intradialytic exercise can be a safe, effective, and easy-to-implement non-pharmacological strategy to improve the comfort and quality of life of hemodialysis patients.

However, most studies used quasi-experimental designs with limited sample sizes and varying intervention protocols, so the long-term effectiveness of exercise still needs to be confirmed. Future

research is recommended to use randomized controlled trials with larger sample sizes, uniform exercise protocols, and long-term evaluation of the intervention's effectiveness and sustainability. Furthermore, the implementation of intradialytic exercise needs to be supported by the development of clear standard operating procedures (SOPs), covering the type, duration, frequency of exercise, and patient safety monitoring. Future research should also explore the impact of these exercises on quality of life and other clinical outcomes to strengthen the integration of intradialytic exercise into hemodialysis nursing practice.

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