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Original Article

Application of pursed-lip breathing to reduce fatigue in hemodialysis patients: A nursing case study

Ririn Dwi Aneja[1*], Dedi Fatrida[2]
[1] Program Studi Pendidikan Profesi Ners, Institut Kesehatan Mitra Bunda, Batam, Indonesia
[2] Institut Kesehatan Mitra Bunda, Batam, Indonesia

***Corresponding Author:**
Ririn Dwi Aneja
Program Studi Pendidikan Profesi Ners, Institut Kesehatan Mitra Bunda, Batam, Indonesia
Email: ririndwianj@gmail.com

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Abstract

Background: Chronic Kidney Disease (CKD) is a serious global health problem with a rapidly increasing prevalence. The disease is characterized by a progressive and irreversible decline in kidney function. In advanced stages, patients require renal replacement therapy, such as hemodialysis. Fatigue is one of the most common and debilitating symptoms experienced by patients undergoing hemodialysis, negatively affecting daily functioning and quality of life.
Objective: This study aimed to describe nursing care for a patient with CKD through the application of pursed-lip breathing to reduce fatigue levels in the Hemodialysis Unit.
Methods: This study employed a nursing case study design based on the nursing process. The subject was Mrs. S, a patient with CKD undergoing routine hemodialysis. Fatigue was assessed using the Fatigue Severity Scale (FSS), with an initial score of 52, indicating fatigue. The nursing diagnosis was exhaustion related to physiological conditions (chronic disease: CKD) and long-term treatment (hemodialysis). The nursing intervention consisted of the application of pursed-lip breathing, implemented over four consecutive visits during hemodialysis sessions.
Results: The evaluation demonstrated a gradual reduction in fatigue levels. The FSS score decreased from 46 on the first day, to 40 on the second day, 36 on the third day, and reached 30 on the fourth day, indicating no fatigue. In addition, the patient verbalized improved energy recovery, increased strength, reduced feelings of fatigue and lethargy, and improved appetite, consistent with the expected nursing outcomes.
Conclusion: The application of pursed-lip breathing as a nursing intervention was associated with a reduction in fatigue levels in a patient undergoing hemodialysis. This technique may be incorporated into routine nursing care to help manage fatigue and support quality of life among patients with CKD. Patients are encouraged to practice pursed-lip breathing regularly, particularly when experiencing fatigue during hemodialysis.

Background

Chronic Kidney Disease (CKD) is a serious chronic condition marked by progressive and irreversible deterioration of renal function that disrupts metabolic processes and fluid–electrolyte balance (Lilia & Supadmi, 2020). This progressive decline may lead to the accumulation of metabolic waste products and systemic complications, increasing the clinical complexity of long-term care needs (Chadban et al., 2024). CKD is widely recognized as a major global health challenge due to its high morbidity and mortality burden, with substantial consequences for individuals and health systems (ISN-GKHA, 2023). The escalation of CKD also reflects broader issues of multimorbidity, where co-existing chronic conditions can complicate disease management and outcomes (Gurgel do Amaral et al., 2022). In addition, obesity-related factors may play a role in overall health risk profiles, making anthropometric indicators such as body mass index relevant to long-term chronic disease management contexts (Centers for Disease Control and Prevention, 2024). Therefore, CKD requires comprehensive strategies that address biological, behavioral, and system-level factors in care delivery (Campbell et al., 2022).

The global burden of CKD continues to rise, and contemporary estimates indicate that hundreds of millions of people are affected worldwide (ISN-GKHA, 2023). Beyond mortality, the disease imposes long-term economic burdens associated with progressive care needs and renal replacement therapy, amplifying the urgency of prevention and early management (Chadban et al., 2024). A crucial challenge in CKD management is ensuring that patients can access, understand, and use health information, because these skills directly influence adherence and self-care (Baker, 2006). Evidence shows that health literacy disparities exist across rural and urban populations, which may translate into unequal disease management

outcomes in chronic conditions (Aljassim & Ostini, 2020). In CKD, health literacy has been increasingly emphasized as a determinant of self-care and clinical outcomes, particularly in primary care and community settings (Ho et al., 2024). Older adults with CKD are also vulnerable to frailty, and health literacy may intersect with frailty risk, thereby influencing functional status and quality of life (Candemir et al., 2023).

In Indonesia, CKD remains a significant public health issue, with national survey data documenting substantial numbers of physician-diagnosed cases among adults (Kementerian Kesehatan RI, 2019). Regional disparities are notable, and local epidemiological data help clarify the burden at the provincial level, including in the Riau Islands Province (RISKESDAS Provinsi Kepulauan Riau, 2019). In addition, city-level surveillance data are critical for planning service delivery and estimating local needs for CKD-related care in Batam (Crisanto et al., 2022). The progression of CKD often leads to the need for renal replacement therapy, and hemodialysis remains a dominant modality in many contexts due to its availability and clinical indications (Septiwi, 2023). However, dialysis patients face complex symptom burdens that require systematic nursing management and targeted interventions to reduce complications and improve well-being (Musniati, 2024). Effective self-management programs and supportive approaches have been studied in related renal conditions and may offer transferable insights for improving long-term outcomes (Hinkhaw et al., 2019).

Hemodialysis is associated with a substantial symptom burden, with fatigue consistently reported as one of the most common and distressing symptoms in end-stage renal disease populations (Davey et al., 2019). Fatigue can persist across dialysis sessions and may undermine physical activity, social functioning, and adherence to treatment regimens, ultimately reducing quality of life (Musniati, 2024). Contributing factors may include anemia, long dialysis duration, and hemodynamic instability during treatment, which can reduce oxygen delivery and energy availability (Santoso et al., 2022). Because fatigue affects clinical stability and daily functioning, it is recognized as a priority nursing problem requiring structured assessment and sustained symptom management (Amalia & Aini, 2024). Accurate fatigue measurement is essential for nursing decision-making, and validated scales support reliable monitoring of symptom severity over time in dialysis populations (Rifa et al., 2024). Furthermore, interventions aimed at improving self-management and health literacy may indirectly mitigate symptom burdens by enhancing patient engagement and communication in clinical care (Boonstra et al., 2021a).

Management of fatigue in CKD and hemodialysis may be delivered through pharmacological and non-pharmacological approaches, with increasing attention to supportive behavioral strategies (Davey et al., 2019). Non-pharmacological interventions such as progressive muscle relaxation have demonstrated benefits in reducing fatigue among hemodialysis patients and can be integrated into nursing care plans (Riyana & Nurhalimah, 2023; Amalia & Aini, 2024). Breathing-based interventions are also used to support physiological stability and perceived symptom control, including relaxation-oriented breathing exercises applied in chronic disease contexts (Almayrs et al., 2024; Septiwi, 2023).

Pursed-lip breathing (PLB), commonly studied in respiratory conditions, can influence breathing patterns and respiratory rate, suggesting a physiologic basis for symptom relief in appropriate populations (Azizah et al., 2018). In CKD care, multi-component health literacy interventions have emphasized the importance of communication strategies and practical skill-building to support self-management, which may complement symptom-focused interventions (Boonstra et al., 2021b). Qualitative evidence also indicates that limited health literacy can hinder self-management optimization, implying that symptom management strategies should be delivered with communication approaches that match patient capacity (Boonstra et al., 2022).

Although evidence on PLB for fatigue in hemodialysis remains limited compared with its use in pulmonary conditions, several nursing case-based and applied studies suggest potential benefits for fatigue reduction in CKD populations. Clinical nursing care reports have described the use of PLB in hemodialysis patients with fatigue as a feasible and low-cost intervention that can be taught and practiced

routinely (Putri, 2024). Applied intervention reports also indicate improvements in fatigue scores after PLB implementation in CKD patients, supporting the clinical relevance of this approach for symptom management (Salamah et al., 2022; Sari et al., 2025). These findings align with broader evidence indicating that breathing and relaxation techniques can improve symptom perception and support self-regulation during chronic treatment processes (Almayrs et al., 2024). At the same time, digital and communication-based education programs have been explored to strengthen patient engagement, which could enhance adherence to self-care practices, including symptom management techniques (Chen et al., 2023). Therefore, integrating PLB into nursing care—while also considering health literacy needs and supportive education—may be a pragmatic strategy to reduce fatigue and improve daily functioning among hemodialysis patients (Campbell et al., 2022; Dawson et al., 2020).

This study aims to describe nursing care through the application of pursed-lip breathing to reduce fatigue levels in a patient with CKD undergoing hemodialysis.

Methods

Study Design

This study employed a nursing case study design focusing on the provision of nursing care through the application of pursed-lip breathing to reduce fatigue in a patient with Chronic Kidney Disease (CKD) undergoing hemodialysis. The case study approach was chosen to allow an in-depth and systematic exploration of nursing interventions and patient responses within a real clinical context.

The study was conducted using the stages of the nursing process, including assessment, nursing diagnosis, planning, implementation, and evaluation. This design is appropriate for examining specific clinical phenomena and evaluating changes over time in individual patients. The case study method enables detailed observation of symptom progression and intervention outcomes.

Therefore, it was considered suitable for exploring fatigue management in a hemodialysis patient.

Sampling

The subject of this study was one patient selected using purposive sampling based on predefined inclusion and exclusion criteria. The inclusion criteria were patients diagnosed with CKD undergoing hemodialysis twice weekly, experiencing fatigue within the last week with a Fatigue Severity Scale (FSS) score ≥36, having compos mentis consciousness, and willing to participate by providing informed consent. The exclusion criterion was the presence of acute respiratory disorders. The study was conducted in the Hemodialysis Unit of Harapan Bunda Hospital, Batam City, in October 2025. A single-subject approach was applied because case studies focus on in-depth analysis of individual clinical experiences. The selected subject, Mrs. S, met all inclusion criteria and agreed to participate in the intervention.

Instrument

Fatigue was assessed using the Fatigue Severity Scale (FSS), a standardized questionnaire consisting of nine items that measure the severity and impact of fatigue on daily functioning. Each item is rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The total score is obtained by summing all item scores, with scores <36 indicating no fatigue and scores ≥36 indicating clinically significant fatigue. The FSS has been widely used in clinical and research settings due to its simplicity and reliability. The Indonesian version of the FSS has demonstrated excellent validity and reliability among patients with CKD undergoing dialysis. Therefore, the FSS was considered an appropriate instrument for measuring fatigue in this study.

Intervention

The nursing intervention implemented in this study was pursed-lip breathing as a non-pharmacological relaxation technique. The intervention was conducted according to a standardized operating procedure, beginning with positioning the patient in a comfortable semi-Fowler, sitting, or supine position. The patient was instructed to inhale slowly through the nose, hold the breath for 2–3 seconds, and exhale slowly through pursed lips for 4–6

counts. The intervention was applied over four visits, consisting of five cycles per day: one cycle during pre-dialysis, three cycles during intra-dialysis, and one cycle during post-dialysis. Each cycle lasted five minutes with a 15-minute rest interval between cycles. After receiving education and demonstration from the researcher, the patient performed the technique independently.

Data Collection

Data collection was conducted through several stages. Initially, a preliminary survey was performed to assess fatigue levels using the FSS. After confirming eligibility, informed consent was obtained from the patient. The researcher then provided education regarding the purpose, benefits, and procedure of pursed-lip breathing. Baseline fatigue assessment was conducted prior to the intervention. Fatigue levels were reassessed after each intervention session using the FSS to monitor changes over time. Additional data were collected through observation, interviews, and nursing documentation to support clinical evaluation.

Data Analysis

Data analysis was conducted descriptively following data collection. Quantitative data from the FSS were summarized to illustrate changes in fatigue scores before and after the intervention. Qualitative data obtained from observations and patient interviews were analyzed narratively to describe the patient's responses to the intervention. The results were presented in a chronological manner to demonstrate trends in fatigue reduction across intervention sessions. Interpretation of findings was performed by comparing pre- and post-intervention conditions and aligning them with existing theoretical and empirical evidence. This approach allowed comprehensive evaluation of the intervention's impact on fatigue.

Ethical Consideration

This study adhered to ethical principles in nursing research. Respect for patient autonomy was ensured by providing complete information regarding the study objectives, procedures, benefits, and potential risks before obtaining informed consent. The principle of beneficence was applied by implementing a safe and non-invasive intervention aimed at reducing patient fatigue. Justice was maintained by selecting participants based solely on established inclusion criteria without discrimination. Confidentiality was protected by using patient initials and safeguarding personal data. The study also received official approval from the hospital, and participation was entirely voluntary without coercion.

Results

Nursing Assessment

The nursing assessment in this case study involved Mrs. S, a 47-year-old patient with a medical diagnosis of Chronic Kidney Disease (CKD) who has been undergoing hemodialysis since 2023. The patient had a history of uncontrolled hypertension for 20 years. Laboratory examination results dated October 1, 2025 showed a hemoglobin level of 6.5 g/dL and an erythrocyte count of 2.58×10^6/µL, both of which were below normal values. Vital sign assessment revealed blood pressure of 157/83 mmHg, pulse rate of 74 beats per minute, body temperature of 36.5°C, respiratory rate of 22 breaths per minute, and oxygen saturation (SpO_2) of 99%. Nursing assessment related to fatigue identified major and minor subjective and objective data. Subjectively, the patient complained of feeling tired, weak, and lacking energy.

The patient reported experiencing persistent fatigue since starting hemodialysis and stated that energy levels did not fully recover despite sleeping. The patient reported routinely taking naps for 1–2 hours per day but had difficulty initiating sleep at night, with total sleep duration of 5–6 hours per day. The patient also stated having low energy for traveling, especially when walking, due to rapid onset of fatigue. Additionally, the patient reported decreased appetite and often did not finish meals when feeling fatigued. The patient consumed meals twice daily consisting of rice, side dishes, and vegetables in small portions that were sometimes unfinished, with no use of dietary supplements or Erythropoiesis-Stimulating Agents (ESA). Objectively, the patient appeared lethargic and less active during interactions. Fatigue assessment using

the Fatigue Severity Scale (FSS) yielded a score of 52, indicating fatigue.

Nursing Diagnosis

Data analysis from the nursing assessment indicated that Mrs. S had a nursing diagnosis of fatigue related to physiological conditions (chronic disease: Chronic Kidney Disease) and long-term treatment programs (hemodialysis) (D.0057) (PPNI, 2017). Subjective data included complaints of feeling tired, weak, and lacking energy; persistent fatigue since undergoing hemodialysis despite rest; inability to tolerate long-distance activities due to rapid fatigue, particularly during walking; and decreased appetite when feeling fatigued. Objective data revealed that the patient appeared lethargic and less active during interactions. This diagnosis was further supported by the fatigue assessment using the Fatigue Severity Scale (FSS), which showed a score of 52, indicating clinically significant fatigue.

Nursing Intervention

The nursing intervention for the problem of fatigue referred to the Indonesian Nursing Intervention Standards (SIKI) by PPNI specifically relaxation therapy (I.09326). Observational interventions included identifying decreased energy levels, impaired concentration, or other symptoms that interfered with cognitive functioning; identifying relaxation techniques previously used effectively; assessing the patient's willingness, ability, and prior use of relaxation techniques; assessing muscle tension, pulse rate, blood pressure, and body temperature before and after exercises; and monitoring the patient's response to relaxation therapy. Therapeutic interventions included creating a calm, distraction-free environment with comfortable lighting and room temperature; providing written information about preparation and procedures for the pursed-lip breathing relaxation technique when possible; encouraging the use of loose clothing; and using a soft voice with a slow rhythm. Educational interventions included explaining the purpose, benefits, limitations, and types of pursed-lip breathing relaxation; providing detailed explanations of the pursed-lip breathing intervention; encouraging the patient to assume a comfortable position; encouraging relaxation and awareness of relaxation sensations during pursed-lip breathing; encouraging frequent repetition or practice of the technique; and demonstrating and training the patient in the pursed-lip breathing relaxation technique.

Nursing Implementation

The implementation for the nursing diagnosis of fatigue related to physiological conditions (chronic disease: Chronic Kidney Disease) and long-term treatment programs (hemodialysis) was conducted in a structured manner. This included identifying decreased energy levels; identifying relaxation techniques previously found effective; assessing the patient's willingness, ability, and prior use of relaxation techniques; assessing muscle tension, pulse rate, blood pressure, and body temperature before and after exercises; and monitoring the patient's response to pursed-lip breathing relaxation therapy. A calm and distraction-free environment with comfortable lighting and room temperature was created. Written information regarding preparation and procedures for the pursed-lip breathing technique was provided, and the patient was encouraged to wear loose clothing. A soft voice with a slow rhythm was used during instruction.

The purpose, benefits, limitations, and types of pursed-lip breathing relaxation were explained, along with detailed instructions for the intervention, which consisted of five cycles per day: one cycle during pre-dialysis, three cycles during intra-dialysis, and one cycle during post-dialysis, each lasting five minutes with a 15-minute rest interval. The patient was encouraged to assume a comfortable position, relax, and focus on the sensations experienced during pursed-lip breathing. The patient was also encouraged to frequently practice the technique. Demonstration and guided practice of the pursed-lip breathing relaxation technique were provided.

Nursing Evaluation

The nursing evaluation was conducted by comparing Fatigue Severity Scale (FSS) scores before and after the implementation of the intervention. The patient's FSS score decreased from 52 to 30, indicating an improvement in the fatigue condition (See Table 1).

After the intervention on the fourth day, the nursing diagnosis of fatigue related to physiological conditions (chronic disease: Chronic Kidney Disease) and long-term treatment programs (hemodialysis) was partially resolved. This was evidenced by subjective evaluation findings, in which the patient reported feeling more refreshed and experiencing increased energy after completing hemodialysis and routinely practicing pursed-lip breathing. The patient also stated being able to walk longer distances independently within the hospital compared to previous days. Although the patient still reported feeling tired, there was a slight improvement in energy recovery following the breathing exercises, hemodialysis sessions, and rest.

Objective data obtained on the fourth day showed that the patient was able to independently perform five cycles of the pursed-lip breathing technique. The patient's appetite appeared to improve, as indicated by the ability to finish a full meal portion without complaints of nausea. The patient appeared more energetic and enthusiastic during the evaluation following the pursed-lip breathing intervention, looked fresher, and was more active during interactions. The patient's facial appearance was not pale or lethargic; however, mild facial edema was still observed. The post-intervention FSS score decreased to 30, indicating the absence of fatigue.

The nursing problem of fatigue was partially resolved, as some outcome criteria based on the Indonesian Nursing Outcome Standards (SLKI) for fatigue level (L.05046) had not been fully achieved, particularly verbalization of energy recovery, which showed only slight improvement. However, several outcome indicators were achieved, including increased energy, decreased verbalization of fatigue, reduced lethargy, and improved appetite. The intervention was continued by the patient independently, particularly practicing the pursed-lip breathing relaxation technique before, during, and after hemodialysis sessions.

Overall, relaxation therapy through the application of pursed-lip breathing was shown to be effective in reducing fatigue levels in patients with CKD undergoing hemodialysis. This intervention can be implemented in hemodialysis units to reduce fatigue associated with hemodialysis and to support improvements in patients' quality of life.

Table 1. Observation Sheet of Fatigue Levels in Mrs. S

Day/ Date	Intervention	Fatigue Score
Tuesday, August 5, 2025	Pursed-Lip Breathing Intervention	46 (Fatigue)
Friday, August 8, 2025	Pursed-Lip Breathing Intervention	40 (Fatigue)
Tuesday, August 12, 2025	Pursed-Lip Breathing Intervention	36 (Fatigue)
Friday, August 15, 2025	Pursed-Lip Breathing Intervention	30 (No Fatigue)

Discussion

Fatigue is one of the most prevalent and distressing symptoms experienced by patients with Chronic Kidney Disease (CKD) undergoing hemodialysis. Previous studies have reported that fatigue affects approximately 60–97% of dialysis patients, with higher prevalence among those receiving long-term hemodialysis (Davey et al., 2019; Almayrs et al., 2024). The high prevalence of fatigue reflects the complex pathophysiology of CKD, including anemia, uremia, metabolic imbalance, and hemodynamic instability during dialysis sessions (Santoso et al., 2022). In this case study, the patient initially demonstrated a high Fatigue Severity Scale (FSS) score, indicating clinically significant fatigue. These findings are consistent with national and international evidence that fatigue remains a major nursing problem in patients undergoing renal replacement therapy (Musniati, 2024). Therefore, effective fatigue management is essential to improve functional capacity and quality of life in this population.

The reduction in fatigue observed in this study may be explained by the physiological mechanisms underlying pursed-lip breathing (PLB). PLB is a breathing exercise that prolongs expiration, improves ventilation efficiency, and

enhances oxygen delivery to body tissues (Azizah et al., 2018). Improved oxygenation may help reduce perceived exertion and increase energy availability, which are critical factors in fatigue management among CKD patients (Septiwi, 2023). Furthermore, PLB promotes relaxation by reducing sympathetic nervous system activity and enhancing parasympathetic responses, contributing to a calming physiological effect (Almayrs et al., 2024). These mechanisms support the observed decrease in fatigue scores following regular PLB practice. Thus, PLB appears to be a physiologically plausible intervention for fatigue reduction in hemodialysis patients.

The findings of this case study are consistent with previous nursing studies that reported the effectiveness of PLB in reducing fatigue among CKD patients. Suprihatin et al. (2022) demonstrated a significant reduction in fatigue scores after implementing PLB across pre-, intra-, and post-dialysis phases. Similarly, Salamah et al. (2022) found that PLB effectively reduced fatigue levels within three days of intervention in CKD patients. Sari et al. (2025) also reported improvements in fatigue outcomes following PLB implementation, reinforcing its potential role as a supportive nursing intervention. The consistency of these findings suggests that PLB may have a reproducible effect on fatigue reduction across different clinical settings. This case study further strengthens the evidence by demonstrating similar benefits in a real-world hemodialysis context.

In addition to physiological benefits, PLB may contribute to improved self-management and patient engagement in care. Non-pharmacological interventions that are simple, low-cost, and easy to perform independently empower patients to take an active role in managing their symptoms (Amalia & Aini, 2024). The patient in this study was able to independently perform PLB after education and demonstration, indicating good acceptability and feasibility. This aligns with evidence showing that self-management strategies can enhance coping and symptom control in chronic illness (Hinkhaw et al., 2019). Moreover, effective communication and patient education are crucial to ensure adherence to such interventions (Baker, 2006). Therefore, PLB not only addresses fatigue physiologically but also supports patient autonomy in daily symptom management.

Fatigue management in CKD requires a comprehensive nursing approach that integrates assessment, intervention, and evaluation. The use of the Fatigue Severity Scale (FSS) in this study provided a reliable and valid method for monitoring changes in fatigue over time, as supported by validation studies in CKD populations (Rifa et al., 2024). Accurate assessment enables nurses to tailor interventions and evaluate their effectiveness systematically. In this case, the gradual reduction in FSS scores across four visits indicated a positive response to the intervention. Such structured evaluation is essential for evidence-based nursing practice in hemodialysis units (Riyana & Nurhalimah, 2023). Therefore, standardized assessment tools should be routinely incorporated into fatigue management protocols.

Despite the positive outcomes, this case study has limitations that should be acknowledged. The use of a single-subject design limits the generalizability of the findings to broader CKD populations. Fatigue is a multifactorial symptom influenced by anemia, nutritional status, psychological factors, and dialysis adequacy, which were not fully controlled in this study (Santoso et al., 2022). Additionally, improvements in fatigue may have been influenced by other supportive care measures during hemodialysis. Nevertheless, case studies provide valuable clinical insights and contribute to practice-based evidence, particularly for nursing interventions that are underexplored in larger trials (Yona, 2006). Further studies with larger samples and controlled designs are recommended to confirm these findings.

Overall, the findings of this case study highlight the potential role of pursed-lip breathing as an effective non-pharmacological nursing intervention for reducing fatigue in patients with CKD undergoing hemodialysis. The intervention demonstrated measurable improvements in fatigue levels, functional

activity, and subjective well-being. Given its simplicity, safety, and low cost, PLB can be integrated into routine nursing care in hemodialysis units (Septiwi, 2023). Incorporating PLB into standard nursing protocols may contribute to improved symptom management and quality of life for CKD patients. Therefore, nurses are encouraged to adopt and promote PLB as part of comprehensive fatigue management strategies in hemodialysis care.

Conclusion and Recommendation

This case study demonstrates that the application of pursed-lip breathing as a nursing intervention was effective in reducing fatigue levels in a patient with Chronic Kidney Disease undergoing hemodialysis. The intervention resulted in a significant decrease in the Fatigue Severity Scale score, accompanied by improvements in energy levels, physical activity tolerance, and appetite. Pursed-lip breathing is a simple, safe, and low-cost non-pharmacological intervention that can be easily taught and practiced independently by patients. Therefore, integrating pursed-lip breathing into routine nursing care in hemodialysis units is recommended to support fatigue management and enhance the quality of life of patients with CKD.

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Declaration on the Use of AI
No AI tools were used in the preparation of this manuscript.

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