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The Application of 30° Foot Elevation and Ankle Pump Techniques to Reduce Lower Limb Edema in Patients with Chronic Kidney Disease

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Abstract:
Lower extremity edema is a common complication in patients with stage 5 chronic kidney disease (CKD) due to fluid imbalance. Non-pharmacological therapies such as ankle pump exercises and 30°-foot elevation can be effective alternative interventions to reduce edema. This study aims to determine the effectiveness of combining ankle pump exercises and 30°-foot elevation in reducing the degree of edema in CKD patients. This research employed a quantitative descriptive case study method involving one patient with stage 5 CKD. The intervention consisted of ankle pump exercises and 30°-foot elevation conducted over three consecutive days. Each ankle pump session lasted 1 minute per position, and foot elevation was maintained for 5–10 minutes per session. Edema assessment was conducted pre- and post-intervention using the Grading Pitting Edema scale. The study showed no reduction in the edema grade from day one to day three. However, a decrease in edema depth was observed on the third day of the intervention, indicating that no significant reduction in the overall edema grade occurred. The application of ankle pump exercises and 30°-foot elevation over three days did not show a clinically significant reduction in edema. However, a positive effect began to emerge on the third day, with a 1 mm decrease in edema depth. The combination therapy has the potential to reduce lower extremity edema in CKD patients, but it requires consistent application and optimal intensity to achieve significant outcomes. This intervention may serve as a safe, non-invasive, and practical non-pharmacological option in evidence-based nursing care.

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INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive and irreversible disorder characterized by a gradual decline in renal function, ultimately impairing the kidneys' ability to filter metabolic waste, regulate fluid and electrolyte balance, and maintain acid–base homeostasis (Ahmed et al., 2025; Widayati et al., 2025). As nephron loss accumulates due to underlying pathologies such as glomerulosclerosis, tubulointerstitial fibrosis, and chronic inflammation, the glomerular filtration rate (GFR) decreases significantly, often culminating in end-stage renal disease (ESRD) (Wang & Zhang, 2023). This systemic dysfunction not only disrupts metabolic and endocrine processes but also contributes to a constellation of clinical complications that profoundly affect patients' quality of life (Kushwaha et al., 2023). Management of advanced CKD typically involves renal replacement therapies, most commonly hemodialysis, which is administered two to three times weekly to mitigate toxin accumulation and fluid overload (Elendu et al., 2023; Agustin et al., 2023).

Despite the life-sustaining benefits of hemodialysis, patients with CKD frequently experience persistent fluid imbalances between treatment sessions due to residual renal insufficiency and

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challenges in adhering strictly to fluid and dietary restrictions (Hasan et al., 2024). One of the most prevalent clinical manifestations of fluid volume excess is peripheral edema, particularly in the lower extremities (Smith et al., 2024). This condition arises from increased capillary hydrostatic pressure, reduced oncotic pressure, and impaired lymphatic drainage, factors that are exacerbated by prolonged sitting or standing, venous stasis, and reduced mobility (Singh & Revand, 2022). Lower limb edema not only causes discomfort and functional limitations but also predisposes patients to serious complications such as skin breakdown, ulceration, cellulitis, and deep vein thrombosis, thereby increasing morbidity and healthcare utilization (Govender & Howard, 2025).

In this context, non-pharmacological nursing interventions play a pivotal role in managing fluid-related symptoms and enhancing patient outcomes. Among these, ankle pump exercises and limb elevation have emerged as simple, cost-effective, and evidence-informed strategies to promote venous and lymphatic return (Nursanti et al., 2024). Ankle pumps, rhythmic dorsiflexion and plantarflexion movements, activate the calf muscle pump, which enhances venous flow toward the heart and reduces venous pooling in the lower extremities (Maharem et al., 2022; Rondhianto et al., 2025). Concurrently, elevating the legs to a 30° angle above heart level leverages gravity to facilitate fluid redistribution from interstitial spaces back into the vascular compartment, thereby alleviating edema. These techniques are particularly suitable for patients with CKD, who often face restrictions on diuretic use or require adjunctive approaches to complement dialysis (Putri et al., 2025).

Although the physiological mechanisms supporting these interventions are well established in general circulatory physiology, their specific application and efficacy in the CKD population remain underexplored in the clinical literature. Existing studies on edema management have primarily focused on heart failure, venous insufficiency, or postoperative settings, with limited attention to patients undergoing long-term hemodialysis (Abassi et al., 2022). Given the unique fluid dynamics and comorbidities associated with CKD, including vascular calcification, autonomic dysfunction, and altered tissue compliance, it is essential to evaluate the tailored effectiveness of such non-invasive strategies within this vulnerable group. Integrating these techniques into routine nursing care could offer a practical, patient-centered approach to symptom management and functional preservation (Markarian et al., 2024).

Therefore, this article aims to examine the combined application of 30°-foot elevation and ankle pump exercises as a non-pharmacological intervention to reduce lower limb edema in patients with CKD undergoing hemodialysis. By synthesizing current evidence and clinical observations, this discussion aims to highlight the potential of these accessible, low-risk strategies to enhance comfort, mobility, and integumentary integrity in a population affected by chronic fluid overload. The findings may inform nursing protocols and support the integration of proactive, rehabilitative measures into standard CKD care pathways (Kusumawati et al., 2025).

STUDY DESIGN

This study utilized a descriptive quantitative case study design involving a single patient diagnosed with stage 5 chronic kidney disease (CKD). The intervention consisted of ankle pump exercises and 30°-foot elevation, performed over three consecutive days (January 20, 21, and 22). Each ankle pump session lasted 1 minute per position, while foot elevation was maintained for 5–10 minutes per session. Edema was assessed using the Grading Pitting Edema scale both before and after the intervention. The sampling technique used was consecutive sampling, in which a single patient was selected based on identity, current clinical condition, and the presence of both objective and subjective swelling complaints.

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This study received ethical approval from the Faculty of Nursing, Universitas Jember, ensuring that all research procedures adhered to established ethical principles in human subject research. The ethical clearance confirmed that the study upheld the rights, dignity, and well-being of participants, including obtaining informed consent, ensuring confidentiality, and minimizing any potential physical or psychological harm. The approval also verified that the research design, data collection methods, and intervention protocols, comprising 30°-foot elevation and ankle pump exercises, were conducted in accordance with national and institutional guidelines for ethical research involving human participants. This ethical oversight reinforces the study's integrity and commitment to responsible, patient-centered investigation in nursing care for individuals with chronic kidney disease (CKD).

PATIENT INFORMATION

Based on the assessment conducted on the patient and his spouse, one of the identified nursing problems was hypervolemia. This diagnosis was established based on the patient's clinical signs and symptoms during hospitalization. The patient initially presented to the hospital with complaints of shortness of breath and is a regular hemodialysis patient, undergoing treatment twice a week. The assessment revealed the following objective data: bilateral lower extremity edema, respiratory rate of 26 breaths/min, positive fluid balance of +430 mL, SpO_2 of 98% (with NRBM), and a hemoglobin (Hb) level of 6.8 g/dL. The subjective complaint reported by the patient was dyspnea. Based on this analysis, the appropriate nursing diagnosis was identified as hypervolemia related to excessive fluid intake. The nursing intervention provided over three days, from January 20 to 22, 2025, focused on fluid volume management for the patient. The nursing care plan included: assessing signs and symptoms of hypervolemia (e.g., edema, dyspnea); monitoring fluid intake and output; evaluating the degree of edema; restricting fluid intake; and implementing ankle pump exercises and 30°-foot elevation as adjunctive non-pharmacological interventions. The nursing problem was considered partially resolved at the end of the intervention period, as evidenced by reduced edema and improved fluid balance.

CLINICAL FINDINGS

Mr. E, a 60-year-old male, was diagnosed with Stage 5 chronic kidney disease (CKD) accompanied by anemia, dyspnea, and acute decompensated heart failure (ADHF). The patient is a farmer with a primary school education background and undergoes routine hemodialysis twice weekly at dr. Soebandi Regional Hospital. On January 16, 2025, one day post-hemodialysis, the patient complained of shortness of breath, coughing, nausea, and vomiting, and was brought to the emergency department (ED) on January 18 due to worsening symptoms. Clinical examination revealed elevated vital signs, +2 pitting edema of the lower extremities, intercostal retractions, and bilateral pulmonary rales. Laboratory investigations revealed severe anemia (Hb 6.8 g/dL), hypokalemia (K^+ 2.78 mEq/L), hyponatremia, thrombocytopenia, and a significantly reduced glomerular filtration rate (GFR 8.23 mL/min/1.73 m^2), consistent with end-stage renal disease (ESRD). Established nursing diagnoses included fluid volume excess, ineffective peripheral perfusion, ineffective airway clearance, and decreased cardiac output. The primary intervention for fluid overload focused on restricting fluid intake and monitoring 24-hour fluid balance. As a non-pharmacological adjuvant therapy, the patient received ankle pump exercises and 30° leg elevation for three consecutive days, consisting of 10 repetitions (1 minute of flexion, 1 minute of extension, and 2 minutes of rest) each. The intervention results showed clinical improvement, including reduced

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dyspnea, improved cough effectiveness, and decreased edema, suggesting that this technique may be beneficial in supporting hypervolemia management in patients with advanced-stage CKD.

THERAPEUTIC INTERVENTION

The researcher implemented nursing interventions based on the patient's condition and relevant theoretical guidelines. The nursing care plan was formulated in accordance with the Indonesian Nursing Intervention Standards (SIKI), one of which focuses on managing fluid volume excess (hypervolemia). The following interventions were carried out: Observational: 1)Assess signs and symptoms of hypervolemia (e.g., orthopnea, edema, dyspnea, adventitious breath sounds), 2)Identify the underlying causes of hypervolemia, 3)Monitor fluid intake and output, 4)Monitor for signs of hemoconcentration (e.g., sodium level, BUN, hematocrit, urine specific gravity, 5)Assess the degree of edema, Therapeutic: 6)Restrict fluid and sodium intake, Educational: 7)Educate the patient on fluid restriction techniques, 8)Advise the patient to report urine output of less than 0.5 mL/kg/hour within 6 hours, Collaborative: 9)Collaborate with the medical team for diuretic administration. In total, nine primary nursing interventions were delivered to Mr. E. Additionally, supportive interventions included ankle pump exercises and 30° foot elevation, performed once daily.

Ankle Pump and 30° Foot Elevation

These supportive interventions were applied to reduce the degree of edema in Mr. E, who was experiencing fluid overload with noted pitting edema. After implementing the intervention over a period of three consecutive days (January 20–22, 2025), the following outcomes were observed:

Table 1. Intervention Outcome

Outcome Criteria	Intervention day	Assessment	
		Pre-Intervention	Post- Intervention
	1 (20/01/2025)	+2 (5 mm)	+2 (5 mm)
	2 (21/01/2025)	+2 (5 mm)	+2 (5 mm)
	3 (22/01/2025)	+2 (5 mm)	+2 (4mm)

The results of the ankle pump exercise and leg elevation intervention did not demonstrate specific effectiveness in reducing edema during the initial phase of implementation. This was evidenced by observations on day one and day two, during which the edema grade remained at +2, with a depth of 5 mm, indicating no significant change in edema size or severity. On day three, there was a 1 mm reduction in edema depth, suggesting a slight improvement, although the overall edema depth remained unchanged.

DISCUSSION

Foot Elevation Technique

The application of a 30°-foot elevation for 8–10 minutes, 2–3 times per day over three days, in patients with chronic kidney disease (CKD) did not result in a significant reduction in edema grade. However, a slight decrease in edema depth was observed. Physiologically, leg elevation at 30° can enhance venous return and facilitate the oxidation of sodium and potassium, thereby helping to reduce fluid retention (Arifin Noor et al., 2023). This mechanism also utilizes gravity to promote the return of venous and lymphatic flow to the heart. However, the effectiveness of this technique in CKD patients is limited due to damage to the peritubular capillary glycocalyx, which increases

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capillary permeability. This condition cannot be reversed merely by foot elevation (Ermert et al., 2023). Furthermore, the patient in this case had been living with CKD for over 8 years, suggesting chronic structural capillary damage.

In addition, although there was a minor improvement, such as a decrease in edema depth, the technique remained suboptimal when applied for only three days. Studies have shown that in patients with chronic venous insufficiency, a higher elevation angle (45°–60°) is more effective in improving venous hemodynamics and reducing edema. The success of elevation therapy is highly influenced by the angle used, with higher angles correlating with a more significant reduction in leg circumference. While 30° leg elevation is considered a relatively safe, non-pharmacological intervention, the duration and angle of elevation must be tailored to the patient's clinical condition. Excessive elevation angles above 45° may impair peripheral arterial perfusion and cause discomfort such as back pain or muscle fatigue (Ielapi et al., 2022).

Angkle Pump Technique

After three days of intervention, no significant reduction in edema grade was observed in the patient. One suspected contributing factor was the suboptimal frequency of the intervention. Li et al. (2020) found that high-frequency ankle pump exercises (APE) are more effective at enhancing venous blood flow than low-frequency routines. They recommend performing 60 repetitions per minute for 3 minutes in patients without lower limb fatigue (N-LLF) and 2 minutes in those with fatigue (LLF) to prevent muscle exhaustion, which could reduce patient adherence. This intervention operates through skeletal muscle contractions that facilitate venous return to the heart, thereby improving circulatory flow. The optimal duration is 10–15 minutes, performed twice over two days, as in the present study, which applied the technique only once daily, potentially contributing to its lower therapeutic effectiveness (Shi et al., 2023).

Additionally, the effectiveness of the ankle pump technique is significantly influenced by electrolyte balance, particularly sodium and potassium levels. These electrolytes play a crucial role in regulating osmotic pressure and maintaining balance between intra- and extracellular fluids. When levels are low, as in this patient, fluid accumulation may occur, worsening the edema. Ankle pump exercises enhance venous return and promote the oxidation of sodium and potassium within blood vessels, thereby contributing to the reduction of edema (Nursanti et al., 2024). However, the combination of ankle pump and 30° leg elevation in this case did not significantly reduce edema; rather, it accelerated its resolution. Therefore, this technique may be more effective in the early stages of CKD and when electrolyte levels are within the normal range.

CONCLUSION

The combined ankle pump exercise and 30°-foot elevation over three days did not result in a significant reduction in edema grade in the CKD patient. However, there was a 1 mm decrease in edema depth on the third day. Several factors may have contributed to the limited effectiveness of this intervention, including suboptimal frequency and duration, increased capillary permeability resulting from glycocalyx damage, and electrolyte imbalances, particularly in sodium and potassium levels. Physiologically, ankle pump exercises and leg elevation support venous return and may assist in reducing fluid volume, but their effectiveness depends heavily on consistency and proper adjustment to the patient’s clinical condition. Nevertheless, this therapy remains a promising non-pharmacological approach in edema management, especially when integrated with medical treatment and comprehensive patient monitoring.

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CONFLICT OF INTEREST

There is no conflict of interest in this article.

REFERENCES

Abassi, Z., Khoury, E. E., Karram, T., & Aronson, D. (2022). Edema formation in congestive heart failure and the underlying mechanisms. *Frontiers in Cardiovascular Medicine, 9,* 933215. https://doi.org/10.3389/fcvm.2022.933215

Agustin, L., Mofidah, & Wardani, H. R. (2023). Nursing Care of Chronic Kidney Disease with Activity Intolerance Nursing Problems: A Case Study. *Health and Technology Journal (HTechJ), 1*(4), 400–405. https://doi.org/10.53713/htechj.v1i4.88

Ahmed, K., Dubey, M. K., Dubey, S., & Pandey, D. K. (2025). Chronic kidney disease: Causes, treatment, management, and future scope. In *Computational Intelligence for Genomics Data* (pp. 99-111). Academic Press. https://doi.org/10.1016/B978-0-443-30080-6.00010-9

Elendu, C., Elendu, R. C., Enyong, J. M., Ibhiedu, J. O., Ishola, I. V., Egbunu, E. O., Meribole, E. S., Lawal, S. O., Okenwa, C. J., Okafor, G. C., Umeh, E. D., Mutalib, O. O., Opashola, K. A., Fatoye, J. O., Awotoye, T. I., Tobih-Ojeanelo, J. I., Ramon-Yusuf, H. I., Olanrewaju, A., Afuh, R. N., Adenikinju, J., … Yusuf, A. (2023). Comprehensive review of current management guidelines of chronic kidney disease. *Medicine, 102*(23), e33984. https://doi.org/10.1097/MD.0000000000033984

Ermert, K., Buhl, E. M., Klinkhammer, B. M., Floege, J., & Boor, P. (2023). Reduction of Endothelial Glycocalyx on Peritubular Capillaries in Chronic Kidney Disease. *American Journal of Pathology, 193*(2), 138–147. https://doi.org/10.1016/j.ajpath.2022.11.003

Govender, D., & Howard, A. Q. (2025). Swelling of the legs and feet. *Surgery (Oxford), 43*(5), 286-298. https://doi.org/10.1016/j.mpsur.2025.03.008

Hasan, H., Rahman, M. H. ., Haque, M. A., Rahman, M. S. ., Ali, M. S. ., & Sultana, S. . (2024). Nutritional Management in Patients with Chronic Kidney Disease: A Focus on Renal Diet. *Asia Pacific Journal of Medical Innovations, 1*(1), 34-40. https://doi.org/10.70818/apjmi.2024.v01i01.05

Ielapi, N., Andreucci, M., Bracale, U. M., Costa, D., Bevacqua, E., Giannotta, N., Bevacqua, M. G., Serraino, G. F., Mastroroberto, P., Provenzano, M., & Serra, R. (2022). Elevate to Alleviate – Evidence Based Vascular Nursing Study. *Nursing: Research and Reviews, 12*(February), 39–45. https://doi.org/10.2147/nrr.s345076

Kushwaha, R., Vardhan, P. S., & Kushwaha, P. P. (2023). Chronic Kidney Disease Interplay with Comorbidities and Carbohydrate Metabolism: A Review. *Life, 14*(1), 13. https://doi.org/10.3390/life14010013

Kusumawati, Istiqomah, I. N., Mashuri, Anggia Astuti, & Laili Nur Azizah. (2025). Ankle pump exercise to reduce edema in congestive heart failure. *Nursing and Health Sciences Journal (NHSJ), 5*(4), 492–499. https://doi.org/10.53713/nhsj.v5i4.588

Li, T., Yang, S., Hu, F., Geng, Q., Lu, Q., & Ding, J. (2020). Effects of ankle pump exercise frequency on venous hemodynamics of the lower limb. *Clinical Hemorheology and Microcirculation, 76*(1), 111–120. https://doi.org/10.3233/CH-200860

Maharem, T. A. S., Shehata, A. M., & Khalil, B. M. (2022). Effect of ankle pump exercise on fatigue sensation, comfort, and lower limb hemodynamics among deep vein thrombosis patients.

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February 2026
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e-ISSN: 2985-959X

International Journal of Health Sciences, 6(S9), 4945–4957. https://doi.org/10.53730/ijhs.v6nS9.14488

Markarian, B., Toro, C., Moreira, K., Polam, S., Mathew, N., & Mayrovitz, H. N. (2024). Assessment Modalities for Lower Extremity Edema, Lymphedema, and Lipedema: A Scoping Review. *Cureus, 16*(3), e55906. https://doi.org/10.7759/cureus.55906

Nursanti, A., Rosyida, R. W., & Setyorini, Y. (2024). The Combination of Ankle Pumping Exercise and 30Ëš Leg Elevation on Foot Edema in Chronic Kidney Disease. *Jurnal Kesehatan Prima, 18*(2), 61–68. https://doi.org/10.32807/jkp.v18i2.1338

Putri, M. ., Idramsyah, I., & Husni, H. (2025). Application Of Contrast Bath Therapy And 30-Degree Foot Elevation To Reduce Foot Edema In Patients With Congestive Heart Failure. *Journal of Vocational Nursing, 6*(1), 19–28. https://doi.org/10.20473/jovin.v6i1.61148

Rondhianto, Rohmah , A. 'Izzatur, Mustakim, & Sutawardana, J. H. (2025). Ankle Pump Exercise and Foot Massage Intervention on Reducing Leg Edema in Chronic Kidney Disease (CKD) Patients. *Health and Technology Journal (HTechJ), 3*(6), 789–796. https://doi.org/10.53713/htechj.v3i6.462

Shi, J., Weng, X., Liu, C., Ge, Y., Chai, L., Ru, X., ... & Huang, X. (2023). The effect of the Ankle Pump Exercise (APE) counter system-assisted ankle pump motion in patients after femoral neck fracture. *BMC Musculoskeletal Disorders, 24*(1), 925. https://doi.org/10.1186/s12891-023-06869-x

Singh, S. K., & Revand, R. (2022). Physiological basis of lower limb edema. In *Approach to lower limb oedema* (pp. 25-43). Springer Nature Singapore. https://doi.org/10.1007/978-981-16-6206-5_3

Smith, B., Park, J., Landi, J. L., McConnell, B., Rahman, A., Omari, A. R., Shahab, Z., Carilli, A., Pearl, K., Kim, B., & Costin, J. M. (2024). Chronic Edema Management of the Lower Extremities. *Cureus, 16*(7), e63840. https://doi.org/10.7759/cureus.63840

Wang, N., & Zhang, C. (2023). Recent Advances in the Management of Diabetic Kidney Disease: Slowing Progression. *International Journal of Molecular Sciences, 25*(6), 3086. https://doi.org/10.3390/ijms25063086

Widayati, Maharani, N. D., & Nistiandani, A. (2025). Interdialytic weight gain and fatigue in chronic kidney disease patients undergoing hemodialysis: A Correlational study. *Nursing and Health Sciences Journal (NHSJ), 5*(2), 264–271. https://doi.org/10.53713/nhsj.v5i2.482