

**Foot Massage for Improving Sleep Quality in Hemodialysis Patients: A Case Study***Laela Nur Nabilah¹, Henni Kusuma², Wahyu Hidayati³, Le-Trinh Lam⁴*^{1,2,3} Department of Nursing, Faculty of Medicine, Diponegoro University, Semarang, Indonesia⁴ Department of Nursing, School of Nursing and Medical Technology, University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam**ARTICLE INFORMATION**

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Sleep disorders are a common and significant issue among hemodialysis (HD) patients, often leading to a decline in their quality of life. Foot massage is one of the non-pharmacological therapies that could be effective in managing sleep disorders. This study explores the potential of foot massage as a nursing intervention to improve sleep quality in hemodialysis patients. This study used a case study approach, involving three HD patients with poor sleep quality at the Hemodialysis Unit of Dr. Kariadi General Hospital, Semarang, in May 2025. The Pittsburgh Sleep Quality Index (PSQI) was an instrument to assess sleep quality before and after the intervention. A foot massage was performed for 10 minutes during dialysis sessions, twice weekly for 4 consecutive weeks. All three participants showed a decrease in PSQI scores after the intervention, indicating improved sleep quality. The most significant decrease occurred in participant 1, from 15 to 8 (a decrease of 7 points), while participants 2 and 3 decreased from 15 to 10 (5 points) and from 13 to 9 (4 points), respectively. In conclusion, foot massage can be a part of a holistic nursing intervention to improve sleep quality in hemodialysis patients. It is a safe, easily applied non-pharmacological therapy that can provide physiological and psychological relaxation effects through improved blood circulation, the release of endorphins, and serotonin stimulation, all of which support sleep.

INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive and irreversible disorder of kidney function lasting more than three months, characterized by a decrease in glomerular filtration rate and structural or functional damage to the kidneys (Calice-Silva *et al.*, 2024). It is a global health problem with a prevalence that continues to increase year on year. Patients with end-stage CKD undergoing regular hemodialysis generally experience various physical, psychological, and social problems, one of which is poor sleep quality (Lilipory, 2019; Simanjuntak, Anand, and Yulistir, 2024). Poor sleep quality is a condition characterized by difficulty sleeping, which may include one or more of the following symptoms: difficulty falling asleep (sleep latency), frequent awakenings during the night, difficulty returning to sleep, waking up too early, and being unable to sleep again, or feeling that sleep is not restful or refreshing. Generally, an individual is considered to have poor sleep quality if these symptoms occur at least 3 to 4 times a week over several weeks (Hamzi *et al.*, 2017).

Data from the World Health Organization (WHO) and the International Society of Nephrology (ISN) indicated that approximately 10–13% of the global population experienced CKD (Kovesdy, 2022). The Indonesian Basic Health Research 2018 (*Riskesdas*) recorded an End-Stage Renal Disease (ESRD) prevalence of 3.8‰, with a significant increase, especially among the productive age group (Kementerian

Kesehatan RI, 2018). Furthermore, ESRD requires renal replacement therapy to filter metabolic waste products. Hemodialysis (HD) is one of the most widely used renal replacement therapies in Indonesia (Kusuma *et al.*, 2018). A preliminary study at the dialysis unit of Dr. Kariadi General Hospital in Semarang selected 5 patients from 178 undergoing hemodialysis for assessment. This assessment found that 4 out of 5 patients (80%) experienced sleep disturbances, including difficulty falling asleep (prolonged sleep latency), frequent nocturnal awakenings, or feeling unrefreshed upon waking. These findings indicated that sleep disturbances were a significant problem experienced by CKD patients undergoing HD. However, the management of sleep disorders in the dialysis unit at Dr. Kariadi General Hospital was currently limited to pharmacological interventions, such as the administration of sleeping pills. Non-pharmacological interventions, such as foot massage, which have been proven to promote relaxation and improve sleep quality, were not routinely implemented in nursing practice at the hospital. Poor sleep quality in hemodialysis patients is caused by many factors, including inadequate dialysis processes that result in suboptimal removal of metabolic toxins. Low blood flow rates can influence this, especially in patients with cardiovascular disorders or unstable hemodynamics. This condition was commonly found in tertiary referral hospitals such as Dr. Kariadi General Hospital, which treats patients with complex comorbidities. In addition, other factors such as chronic itching (uremic pruritus), restless leg syndrome (RLS), muscle pain, mood disorders, and anxiety also worsen the patient's sleep quality. Complications such as anemia (a lack of red blood cells) can also cause hypoxemia (a lack of oxygen during sleep), leading patients to experience shortness of breath during sleep and frequent awakenings at night (Tan *et al.*, 2022). This condition can potentially disrupt comfort, worsen morbidity, and reduce overall quality of life (Ghanbari *et al.*, 2022; Nafsiyah *et al.*, 2025).

In nursing practice, interventions that are clinically effective, safe, easy to implement, and supportive of a holistic approach are crucial. One non-pharmacological intervention with potential to improve sleep quality is foot massage. Many studies have evaluated the effectiveness of foot massage, and the results show that this intervention improves sleep quality. A literature review indicated that more than 25 studies supported the benefits of foot massage as a safe and effective relaxation therapy. Foot massage has been practiced for thousands of years and works by stimulating reflex points on the feet that are linked to the nervous and circulatory systems, thereby influencing various parts of the body by modulating the autonomic nervous system (Wang *et al.*, 2020). In addition, this intervention works by stimulating the nervous system, improving blood circulation, and releasing relaxation hormones such as endorphins, which contribute to reducing tension and increasing comfort, thereby supporting the achievement of more profound and better quality sleep (Ghanbari *et al.*, 2022; Siburian and Silaban, 2023; Permana and Mesya, 2024). Several studies also found that foot massage improved sleep quality in cancer patients, older people, and post-operative patients (Agung, Aprina, and Astuti, 2021; Youniss *et al.*, 2021).

However, there was still limited scientific evidence on the effect of foot massage on HD patients in Indonesia.

Foot massage has several advantages compared to non-pharmacological interventions such as acupressure and progressive muscle relaxation (PMR). Acupressure helps regulate the body's energy balance by applying pressure to specific meridian points. Still, its application requires an exceptional understanding of the location of these points and the correct pressure techniques (Chao, Wade, and Kronenberg, 2008). Meanwhile, PMR requires active patient participation in systematically contracting and relaxing muscle groups, which may be difficult for patients with physical or cognitive limitations (Kato, Vogt, and Kanosue, 2019). In contrast, foot massage is passive for the recipient, easy to perform, and provides significant relaxation effects. Patient acceptance of foot massage is also higher because its gentle movements provide comfort and do not cause pain (Huang *et al.*, 2021). With all these advantages, foot massage is an effective, practical, and safe intervention for naturally and sustainably improving sleep quality. Given the limited use of non-pharmacological interventions to address sleep disorders in HD patients, particularly at Dr. Kariadi General Hospital, this study explores the potential of foot massage as a nursing intervention to improve sleep quality in hemodialysis patients. Through a case study approach, this research not only provides a deeper understanding of the effectiveness of foot massage but also contributes to the development of nursing practices that are more applicable, safe, easy to implement, and responsive to patients' individual needs.

METHOD

This study used a case study approach conducted in conjunction with the nursing care process. The population was end-stage CKD patients undergoing HD and experiencing poor sleep quality at the Dialysis Unit of Dr. Kariadi General Hospital in Semarang from 28 April to 24 May 2025. Three participants were selected using purposive sampling. The inclusion criteria were aged 18–60 years, routinely undergoing HD twice a week for the past 3 months, cooperative, hemodynamically stable, and having a poor score on the Pittsburgh Sleep Quality Index (PSQI) questionnaire; while exclusion criteria included patients with physical disorders in the legs, using femoral HD access, or taking sleeping pills. The identification, problem-solving, and achievement of research objectives were structured using a clinical reasoning framework to support systematic, logical, and patient-oriented nursing decision-making. Data were collected by completing the PSQI questionnaire and reviewing medical records and nursing care documentation. The Pittsburgh Sleep Quality Index (PSQI) is an instrument for assessing sleep quality consisting of 19 questions on a Likert scale. This instrument is valid, with a validity coefficient of 0.944, indicating strong content validity. In addition, the PSQI is reliable, with an overall reliability coefficient (Cronbach's alpha) of 0.845 across the seven components measured (Lu *et al.*,

2014). The total PSQI score is calculated from seven principal components; scores of 5 or more indicate poor sleep quality, and scores of 5 or less indicate good sleep quality.

The intervention consisted of a foot massage from the toes to the heels on both feet for 10 minutes per foot. It combined foot massage therapy with acupressure-based relaxation techniques using aromatherapy oils to enhance the overall relaxation effect. The intervention was performed at least 1 hour after vascular access was established and the dialysis process had begun, when the patient's hemodynamic condition was considered stable. It was implemented twice weekly in accordance with the patient's HD schedule. The data were then processed and presented in tables and graphs of demographic characteristics, clinical conditions, and sleep quality before and after the intervention. The data were analyzed to draw conclusions that addressed the study's focus. This study has undergone an ethical review process and has been approved by the Health Research Ethics Committee of Dr. Kariadi General Hospital. It was conducted in accordance with research ethics principles, including respect for participants' rights, confidentiality of data, and obtaining informed consent before data collection.

RESULT

Participants varied in age, sex, education level, and occupation, which could influence their responses to the intervention. Participant 1 was 32 years old, participant 2 was 39, and participant 3 was the oldest at 60 (Table 1). The younger age of participant 1 provides physiological advantages in responding to interventions, such as better physical adaptability and sleep quality, which tends to be easier to restore than in older individuals. In terms of education, participant 1 had a higher level of education than the other participants (Table 1). A higher level of education can support a better understanding of the intervention instructions and improve compliance with the recommended procedures. This factor also supports the effectiveness of the intervention received. Occupation was also an important factor that distinguished the three participants. Participant 1, who had a relatively flexible job, tended to have more control over their time for rest than participant 2, who worked as an employee with a more structured schedule and potentially a higher workload. However, Participant 3, who was not employed, might have more time to sleep, but advanced age and declining physical condition could make it harder to achieve high-quality sleep. However, all participants had BPJS (Social Security Agency for Health), so there was no difference in access to formal health services. Differences in age, education, and daily activities indicate that demographic characteristics are important in influencing the success rate of interventions to improve sleep quality.

Table1. Distribution of Demographic Characteristics of Participants Undergoing Haemodialysis at Dr. Kariadi General Hospital, May 2025 (N=3)

Demographic Characteristics	Participant 1	Participant 2	Participant 3
Age	32 years	39 years	60 years
Gender	Male	Male	Female
Education	Secondary school	Junior High School	Primary school
Occupation	Merchant	Employee	Not working
Health insurance	BPJS	BPJS	BPJS

Table 2 shows that several factors contribute to variations in intervention outcomes, including comorbidities, HD duration, physical complaints, and HD adequacy scores. Participant 1 had hypertension and diabetes, while others only had hypertension. Participant 1 also had the longest HD duration (19 months), suggesting a longer adaptation period to the routine and side effects of dialysis, and this participant was better accustomed to managing therapy-related complaints. Furthermore, he had the highest HD adequacy (1.2). On the other hand, the low hemoglobin (Hb) levels (7.5 g/dL) in participant 1 could be a barrier. In addition, physical complaints, such as lower-extremity edema in participant 1 and restless leg syndrome in participant 3, might interfere with sleep.

Table 2. Distribution of Clinical Characteristics of Participants Undergoing Haemodialysis at Dr. Kariadi General Hospital, May 2025 (N=3)

Clinical Condition Characteristics	Participant 1	Participant 2	Participant 3
Comorbidities	Hypertension and DM	Hypertension	Hypertension
Duration of HD	19 months	14 months	12 months
Access	Double Lumen	Double Lumen	Double Lumen
Sleep quality	Poor	Poor	Poor
Hb over the past two weeks	7.5 g/dL	9.5 g/dL	9.4 g/dL
Blood pressure before haemodialysis	208/106 mmHg	171/98 mmHg	160/95 mmHg
Blood pressure after HD	176/94 mmHg	182/102 mmHg	172/98 mmHg
Weight before HD	69 kg	48 kg	60 kg
Weight after HD	66 kg	47 kg	60 kg
HD adequacy	1.2	1.1	0.9
Physical complaints	Lower extremity oedema	None	<i>Restless leg syndrome</i>

All three participants showed a decrease in PSQI scores after the intervention, indicating improved sleep quality. The most significant decrease occurred in participant 1, from 15 to 8 (a decrease of 7 points), while participants 2 and 3 decreased from 15 to 10 (5 points) and from 13 to 9 (4 points), respectively. Although all final scores remained in the poor sleep quality category, the decrease indicated a positive response to the intervention (Figure 1).

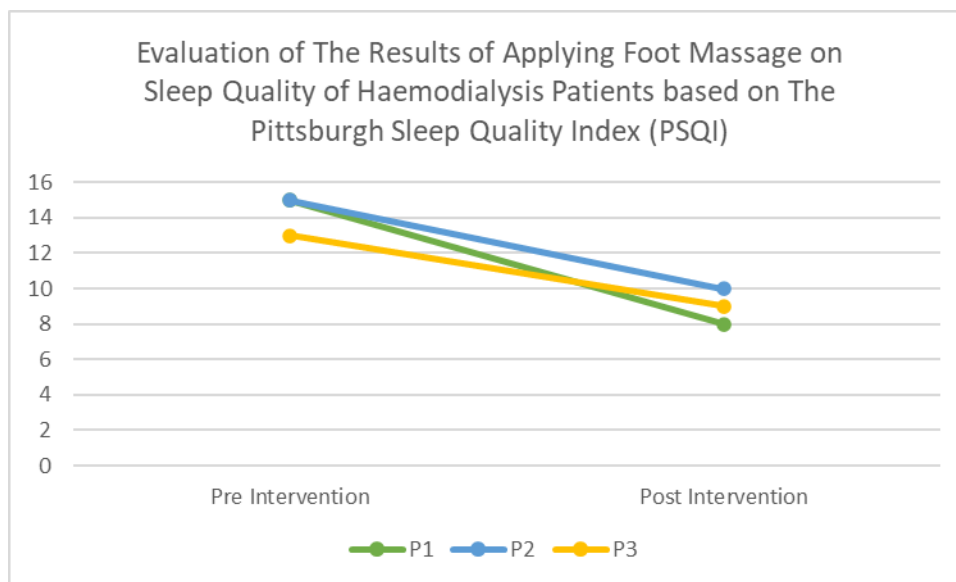


Figure 1. Changes in Sleep Quality Scores After Intervention

DISCUSSION

Chronic kidney disease is a progressive condition characterized by a gradual, irreversible decline in kidney function, in which the glomerular filtration rate (GFR) falls below 60 mL/min/1.73 m² for more than 3 months (Simanjuntak, Anand, and Yulistir, 2024). This decline in kidney function prevents the body from efficiently eliminating metabolic waste products, leading to the accumulation of toxins in the blood, such as urea and creatinine. This condition, known as uremia, has a widespread impact on various organ systems, including the central nervous system. The accumulation of uraemic toxins affects the balance of neurotransmitters such as serotonin and melatonin, which play an important role in sleep regulation. In addition, patients with CKD are also prone to physical symptoms such as muscle pain, cramps, pruritus, and RLS, which can worsen sleep quality. These sleep disturbances are exacerbated by the psychological burden of chronic illness, such as anxiety and depression (Lilipory, 2019). Various non-pharmacological approaches have been developed to address the sleep disturbances frequently experienced by CKD patients, including foot massage as a relaxation therapy.

Foot massage is a simple, safe, and easy-to-apply non-pharmacological intervention that aims to provide a relaxing effect through stimulation, improve blood and body fluid flow, and enhance the delivery of nutrients and oxygen to the body's cells (Simanjuntak, Anand, and Yulistir, 2024). Techniques in foot massage, such as strokes, kneading, rubbing, *tapotement* (tapping), and vibration, work by systematically manipulating the body's soft tissues. These techniques can reduce stress and anxiety, relieve muscle cramps, strengthen the immune system, reduce fatigue due to illness, improve blood circulation, and help overcome insomnia (Ghanbari *et al.*, 2022; Permana and Mesya, 2024). Additionally, foot massage stimulates the limbic system to release Corticotropin-Releasing Factor, which stimulates the pituitary

gland to release the Proopiomelanocortin (POMC) hormone and stimulates the adrenal medulla to increase endorphin secretion, activating the parasympathetic nervous system. It results in vasodilation of blood vessels and improved blood flow, helping tense muscles relax, stimulating the Reticular Activating System (RAS) to release serotonin, promoting sleep onset, and improving sleep quality (Robby, Agustin, and Hanifan Azka, 2022). Increased endorphins and serotonin in the brain produce feelings of physical and psychological relaxation because endorphins also suppress cortisol secretion. Foot massage particularly benefits HD patients because foot massage reduces pain and discomfort and improves sleep quality (Siburian and Silaban, 2023).

A foot massage for HD patients should be performed at least 1 hour after vascular access is established and the dialysis process begins, to ensure the patient's hemodynamic condition remains stable and to avoid potential risks, such as a drop in blood pressure from the massage's relaxing effects. Additionally, this time allows the patient to adapt to dialysis conditions, thereby accepting the intervention more comfortably and safely (Siburian and Silaban, 2023).

This investigation showed a decrease in PSQI scores in hemodialysis patients after foot massage therapy, indicating improvements in sleep duration, efficiency, and soundness (Figure 1). Several studies have shown that foot massage therapy improves sleep quality in patients undergoing HD. Research by Ghanbari et al. (2022) and Siburian & Silaban (2023) found that administering a 10-minute foot massage to each foot for 3 weeks significantly improved sleep quality in HD patients. The Pittsburgh Sleep Quality Index (PSQI) scores increased significantly, indicating improved sleep duration, efficiency, and soundness (Ghanbari *et al.*, 2022; Siburian and Silaban, 2023). Similar findings were reported by Robby et al. (2022), who stated that regular foot massage improved overall sleep patterns in HD patients. The effectiveness of this therapy is supported by the physiological theory that therapeutic touch can stimulate brain regions associated with emotions and relaxation (Robby, Agustin, and Hanifan Azka, 2022). However, discrepancies between this investigation and previous research were variations in participants' demographic characteristics, the duration of the intervention, and the intervention approach. This study combined foot massage therapy with acupressure relaxation techniques and aromatherapy oils, which have not been widely studied in previous research. This combination of interventions provides a more comprehensive relaxation effect and optimizes sleep quality.

The effectiveness of this combination of interventions cannot be separated from the influence of various factors. Several factors influenced the most significant decrease in PSQI scores in participant 1 (Figure 1). First, the age factor: participant 1 was younger, so he tended to show better adaptability and therapeutic response than the other participants. Younger participants showed greater improvement in sleep quality scores. Physiologically, younger individuals have better regenerative and adaptive capacities to therapeutic interventions, including relaxation therapies such as massage. Research by Permatasari et

al. (2022) indicated that young age facilitated entry into the deep sleep phase because the central and peripheral nervous systems are still functioning optimally. However, age is not the most dominant factor in influencing sleep quality. Kusuma's research showed that although old age was associated with insomnia, anxiety had a greater influence on the onset of sleep disorders (Kusuma *et al.*, 2018). It indicated that anxiety was a more significant factor than age in determining the sleep quality of HD patients. In this study, participants who did not experience severe anxiety showed greater improvement in sleep quality. The absence of anxiety makes it easier for the body to achieve a state of relaxation during the intervention. Nurhayati et al. (2019) state that anxiety activates the sympathetic nervous system and inhibits melatonin secretion, disrupting sleep patterns.

Third, the occupational factor also influenced the participant; participant 1 had a relatively light workload and more flexible rest times, allowing the participant to have longer sleep durations and more optimal rest opportunities. Participants with lighter workloads and more flexible rest times were likelier to have better sleep quality. Occupational conditions that are not physically or mentally demanding allow the body to recover and enable more consistent sleep times. Research by Saraswati et al. (2022) showed that individuals with low work stress tended to have better sleep quality due to more stable cortisol levels that did not interfere with circadian rhythms.

Last, from a medical perspective, participant 1 had the highest HD adequacy score among the three participants, indicating better dialysis efficiency. Participant 1, with higher HD adequacy scores, showed a more significant reduction in sleep disturbance scores. An optimal dialysis process can improve patients' physical comfort and overall condition, ultimately enhancing sleep quality. Thus, HD adequacy is also an important indicator. The mechanism relates to HD's effectiveness in removing uremic toxins, such as urea and creatinine. An increase in Kt/V values is directly proportional to a decrease in toxins that can irritate the central nervous system and cause symptoms such as restlessness, muscle cramps, or itching, which can interfere with sleep. Research by Wijaya & Sari (2021) found that Kt/V values ≥ 1.4 were associated with increased physical comfort and improved sleep patterns.

This study found that participant 3, who had restless leg syndrome, experienced the least drop in scores. Physical complaints, such as edema and RLS, can also affect sleep quality. Patients with RLS are more likely to experience sleep disturbances due to uncomfortable leg sensations that occur during rest. This sensation often prompts patients to move their legs, disrupting sleep onset and continuity. It aligns with findings that RLS was a major contributor to sleep disturbances in HD patients (Evinta, Nurhusna, and Subandi, 2025).

The duration of HD treatment also contributes to the response to intervention. Participant 1, who underwent HD for an extended period, tended to show better physiological and psychological adaptation to the side effects of therapy. It allows patients to undergo additional interventions, such as foot massage,

with more positive acceptance. Pratama et al. (2020) explain that long-term adaptation to HD can improve psychological stability and reduce sensitivity to sleep disturbances that commonly occur in the early stages of therapy.

The combination of demographic, psychological, lifestyle, and dialysis factors mutually support and accelerate improvements in sleep quality in participant 1 compared to the other participants. In addition, participant 1 was known to receive independent relaxation stimulation outside the scheduled intervention sessions, which allowed for more optimal therapeutic effects on sleep quality. Thus, Several main factors appear to influence the effectiveness of the intervention in improving sleep quality: age, psychological condition, occupation type, and HD adequacy.

Sleep disturbances in HD patients are caused by the complexity of physical and psychological disturbances due to decreased kidney function. While primary therapies such as HD are essential for sustaining life, additional interventions, such as foot massage, have been shown to improve sleep quality. Therefore, foot massage therapy could be part of a holistic nursing practice focused on patient comfort and improving the quality of life in HD patients.

CONCLUSION

Foot massage can be a part of a holistic nursing intervention to improve sleep quality in hemodialysis patients. It is a safe, easily applied non-pharmacological therapy that can provide physiological and psychological relaxation effects through improved blood circulation, the release of endorphins, and serotonin stimulation, all of which support sleep.

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