



INTRADIALLYTIC EXERCISE-RANGE OF MOTION (IDE-ROM) AND CINNAMON AROMATHERAPY ON ANXIETY, FATIGUE AND SLEEP QUALITY IN HEMODIALYSIS PATIENTS: EXPERIMENT STUDY

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ABSTRACT

Routine hemodialysis patients frequently experience anxiety, chronic fatigue, and sleep disturbances, necessitating a holistic non-pharmacological approach. This study aims to analyze the effect of combined Intradialytic Exercise–Range of Motion (IDE-ROM) and cinnamon aromatherapy on anxiety, fatigue, and sleep quality among patient at RSUD Syarifah Ambami Rato Ebu Bangkalan. This quantitative research employed a quasi-experimental design with a pretest-posttest control group approach. Seventy respondents were selected through purposive sampling and divided into a control group (n=35) and an intervention group (n=35). The intervention group received a combination of IDE-ROM and cinnamon aromatherapy inhalation across six sessions over one month. Data were collected using the Zung Self-Rating Anxiety Scale (SAS), the Functional Assessment of Chronic Illness Therapy (FACIT) fatigue scale, and the Pittsburgh Sleep Quality Index (PSQI). Data analysis was performed using Paired t-tests and MANOVA. The intervention significantly affected all three variables ($p < 0.05$). MANOVA results indicated the strongest effect on sleep quality ($p < 0.001$), while the variables of anxiety ($p = 0.348$) and fatigue ($p = 0.121$) showed lower significance levels compared to sleep quality. The combination of IDE-ROM and cinnamon aromatherapy is effective in improving the physical and psychological conditions of patients. This intervention provides the most dominant influence on enhancing the sleep quality of the respondents.

Keywords: Intradialytic Exercise, Range of Motion (IDE-ROM), Cinnamon Aromatherapy, Anxiety, Fatigue, Sleep Quality, Hemodialysis

INTRODUCTION

Chronic Kidney Disease (CKD) has become a rising global health concern, exacerbated by an aging population and the increasing prevalence of metabolic diseases (Mahyubi, Haksara, & Permana, 2026; Wijayanti et al., 2025). In its 2022 report, the International Society of Nephrology (ISN) estimated that over 850 million people worldwide suffer from kidney disease, with mortality rates climbing significantly (International Society of Nephrology., 2022). Hemodialysis (HD) is the most common renal replacement therapy used to sustain the lives of patients with End-Stage Renal Disease (ESRD). Although this therapy is life-saving, the repetitive and long-term nature of the procedure demands strenuous physiological and psychological adaptation. The complexity of managing this disease impacts not only physical function but also drastically alters the dynamics of the patient's daily life (Kose & Mohamed, 2024).

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Globally, the prevalence of psychophysical disorders among hemodialysis patients has reached alarming levels. A recent study published in 2024 noted that approximately 50.0% of hemodialysis patients experience clinical anxiety (Mahyuvi & Sari, 2024), with the prevalence of sleep disturbances reaching 72.3% (Guo et al., 2024). Furthermore, fatigue, or extreme exhaustion, is reported in 60% to 97% of HD patients, making it the most common and debilitating symptom ((Demirağ & Hintistan, 2022). Data from the Global Burden of Disease Study also highlights that the disease burden resulting from sequelae in renal failure patients has increased by more than 90% over the last three decades, signaling an urgent need for more effective interventions (Melati et al., 2024).

The global prevalence of psychophysical disorders among hemodialysis (HD) patients has reached alarming levels, with 50.0 % of patients experiencing clinical anxiety and up to 72.3% suffering from sleep disturbances (Mahyuvi & Sari, 2024). Fatigue, or extreme exhaustion, is the most common symptom, reported by 60% to 97% of patients, which significantly diminishes their quality of life. This condition is exacerbated by data from the Global Burden of Disease Study, which indicates a surge in the disease burden resulting from renal failure sequelae by over 90% in the last three decades. Clinically, the combination of fatigue and sleep disturbances has been proven to double the risk of hospitalization and cardiovascular mortality, necessitating a paradigm shift from a biochemical focus toward holistic care that addresses the patient's subjective well-being.

Similar trends are observed at the national and local levels, where patients in developing countries often exhibit higher anxiety and fatigue scores due to limited access to supportive rehabilitation therapies (Mahyuvi & Sari, 2023). At RSUD Syarifah Ambami Rato Ebu Bangkalan, primary data from February 2025 recorded high hemodialysis activity, reaching 893 procedures per month. Preliminary results from a study conducted at the hospital reveal a critical phenomenon: 90% of patients experience fatigue, 50% suffer from high anxiety, and 50% have poor sleep quality. The high incidence of fatigue, particularly among long-term HD patients reaching 90% underscores the urgent need for the implementation of more effective supportive interventions within the hemodialysis unit.

Global studies indicate significant variations in the prevalence of psychological disorders among renal failure patients, with depression rates reaching 72.5% in Kenya, 68% in Sudan, and 42% in the Netherlands. In Asian regions such as Singapore and Iran, the average prevalence of anxiety and depression ranges between 31% and 45%, frequently accompanied by chronic sleep disturbances in 40% to 80% of the hemodialysis population (Demirağ & Hintistan, 2022). This condition is exacerbated by the nature of chronic kidney disease, which often remains undetected until advanced stages. Consequently, when patients commence hemodialysis, they are immediately confronted with severe psychological challenges resulting from long-term therapy dependence, health uncertainty, and drastic limitations in daily activities. Pathophysophysiologically, the emergence of fatigue and sleep disturbances in hemodialysis patients is triggered by complex mechanisms involving the accumulation of uremic toxins and systemic inflammation. During the dialysis process, blood contact with the dialyzer membrane triggers the release of pro-inflammatory cytokines, such as IL-6 and TNF-alpha, which induce systemic oxidative stress. Furthermore, physical inactivity during the 4–5 hour procedure



leads to decreased muscle perfusion and muscle wasting (sarcopenia), which are primary contributors to persistent post-dialysis fatigue. The interaction between inflammatory burden and decreased functional muscle capacity forms a cycle that continuously deteriorates the patient's overall quality of life.

From a psychoneuroimmunological perspective, anxiety in hemodialysis patients triggers an overactivation of the Hypothalamus-Pituitary-Adrenal (HPA) axis. This condition increases the secretion of cortisol and norepinephrine, which disrupts the body's circadian rhythm and inhibits the production of melatonin, leading to chronic sleep initiation difficulties (Istiqomah & Mahyuvi, 2023). Neurotransmitter imbalances, such as serotonin and GABA resulting from prolonged stress, further aggravate the patient's anxiety threshold, creating extreme fatigue that cannot be alleviated by standard rest alone (Suwardianto et al., 2025). The high prevalence of these sleep disturbances driven by a combination of hormonal imbalances and physical discomfort requires healthcare providers to give serious attention to psychosocial aspects to maintain the patient's overall quality of life. Managing these issues requires a holistic intervention such as Intradialytic Exercise–Range of Motion (IDE-ROM). This physical exercise during dialysis sessions effectively maintains joint flexibility and improves blood circulation, which has been clinically proven to significantly reduce fatigue levels ($p < 0.001$). Beyond physical improvement, IDE-ROM stimulates the production of endorphins, which play a crucial role in reducing stress and enhancing the patient's mood. By integrating flexibility exercises into nursing care, nurses can help patients achieve better relaxation, reduce psychological burdens, and improve sleep patterns sustainably.

Research by (Kristiani & Yobel, 2022) demonstrates that cinnamon aromatherapy (*Cinnamomum burmannii*) possesses relaxant properties capable of stimulating the central nervous system to enhance tranquility and significantly reduce fatigue and sleep disturbances ($p < 0.001$). Active compounds such as cinnamaldehyde and eugenol in cinnamon provide a calming effect and improve sleep patterns by lowering cortisol levels in the body (Guo et al., 2024). The integration of IDE-ROM physical intervention and this aromatherapy creates a comprehensive synergistic effect; physical exercise serves to reduce muscle tension and increase energy (Forwaty et al., 2019), while aromatherapy provides psychological relaxation that supports deeper sleep and reduces anxiety. The regular application of this combined intervention is expected to significantly improve both the physical and psychological aspects of hemodialysis patients, enabling them to undergo therapy with greater comfort and a better quality of life.

RESEARCH METHODOLOGY

This research is a quantitative study utilizing a quasi-experimental design with a pretest-posttest control group approach. The independent variable is the combination of Intradialytic Exercise-Range of Motion (IDE-ROM) and Cinnamon Aromatherapy, while the dependent variables include anxiety, fatigue, and sleep quality. The researcher selected a sample of 70 respondents ($n=35$ for the intervention group and $n=35$ for the control group) using a purposive sampling technique based on the following inclusion criteria: CKD patients undergoing hemodialysis for at least 5 months (twice a week) at RSUD Syarifah Ambami Rato Ebu Bangkalan, cooperative, fully conscious (GCS 15: E4V5M6), literate, and willing to sign informed consent (Mahyuvi et al., 2021). Exclusion Criteria: Patients with hearing and speech impairments, and patients



who experience complications during hemodialysis (e.g., loss of consciousness, severe hypotension, severe hypertension, stroke, etc.). Data were collected using instruments: anxiety was assessed using the Zung Self-Rating Anxiety Scale (SAS/SRAS), fatigue was measured with the Functional Assessment of Chronic Illness Therapy (FACIT) fatigue scale, and sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI), alongside a demographic characteristics questionnaire. The intervention, combining Intradialytic Exercise-Range of Motion (IDE-ROM) and Cinnamon Aromatherapy, is a therapeutic approach that integrates physical movement during hemodialysis sessions with joint flexibility techniques and aromatic stimulation using cinnamon. The combination of Intradialytic Exercise-Range of Motion (IDE-ROM) and Cinnamon Aromatherapy was administered over six sessions, with each session lasting 60 minutes, over a duration of one month. This study has been declared ethically sound (0062/KEPK/IX/2025 at KEPK RSUD Syarifah Ambami Rato Ebu Bangkalan) and was conducted from September 29 to November 10, 2025, in the Hemodialysis Ward of RSUD Syarifah Ambami Rato Ebu Bangkalan. Data analysis was performed using Paired Sample T-tests and MANOVA.

RESULT AND DISCUSSION
RESULT

The results of the general data characteristics or demographics of the respondents included age, gender, education, and occupation of the intervention and control groups

Table 1. Respondent demographic distribution data

Characteristic Data	Intervention		Control		Equivalenc e Test
	F	%	F	%	
Age					
20 – 30 Years	3	8.6	2	5.7	0.027
31 – 40 Years	12	34.3	4	11.4	
41 – 50 Years	6	17.1	18	51.4	
51 – 60 Years	7	20	8	22.9	
> 61 years old	7	20	3	8.6	
Total Amount	35	100	35	100	
Gender					
Male	19	54.3	20	57.1	0.810
Women	16	45.7	15	42.9	
Total Amount	35	100	35	100	
Education					
	9	25.7	10	28.6	0.305
Elementary School	9	25.7	5	14.3	
Junior High School	3	8.6	8	22.9	
High School	14	40.0	12	34.3	
College					
Total Amount	35	100	35	100	



Jobs					
Cruises	20	57.1	17	48.6	0.289
Driver	5	14.3	8	22.9	
Civil Servant	6	17.1	4	11.4	
Farmer	2	5.7	4	11.4	
Students	2	5.7	2	5.7	
Total Amount	35	100	35	100	

Based on the demographic distribution data in Table 1, the characteristics of the respondents between the intervention and control groups demonstrated a high level of homogeneity across the variables of gender ($p=0.810$), education level ($p=0.305$), and type of occupation ($p=0.289$), indicating that both groups had an equivalent baseline for comparison¹. The majority of respondents were male (54.3%–57.1%) with a higher education background (34.3%–40.0%) and were predominantly employed in the shipping sector (48.6%–57.1%)². Although there was a significant difference in age distribution ($p=0.027$), where the intervention group was more prevalent in the 31–40 age range (34.3%) while the control group was in the 41–50 age range (51.4%), overall, these data provide a solid foundation for measuring the effectiveness of the intervention without significant bias from other demographic factors.

Table 2. Analysis of the effects of the combination of intradialytic exercise-range of motion (IDE-ROM) and cinnamon aromatherapy intervention and control groups on anxiety

Variabel	Groups	n	Mean	SD Deviation	P-value
Anxiety	Intervention	35	46.31	6.999	0.021
	Control	35	49.37	4.015	

Table 2 reinforces the results of comparisons between groups after the intervention. The average level of anxiety in the intervention group after treatment was 46.31, lower than in the control group which had a mean score of 49.37. The $p\text{-value} = 0.021 < 0.05$ means that the combination of intradialytic exercise – range of motion (IDE-ROM) and cinnamon aromatherapy was statistically effective in lowering the patient's anxiety level compared to patients who did not receive the intervention. This confirms that non-pharmacological approaches such as light movement exercises during dialysis combined with natural aromatherapy can be effective strategies to improve the psychological well-being of patients.

Table 3. Analysis of the results of the combination of intradialytic exercise-range of motion (IDE-ROM) and cinnamon aromatherapy intervention and control groups on fatigue

Variabel	Groups	n	Mean	SD Deviation	P-value
Fatigue	Intervention	35	21.43	3.898	0.001
	Control	35	26.43	6.976	

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Table 3, showing table 5.10 shows the results of the comparison between the intervention and control groups after the intervention was performed. The mean fatigue value in the intervention group after treatment was 21.43, lower than in the control group which had a mean value of 26.43. A p-value of < 0.001 indicates that there is a significant difference between the two groups ($p < 0.05$). This means that the combination of intradialytic exercise – range of motion and cinnamon aromatherapy significantly lowered patients' fatigue levels compared to the group that did not receive the intervention. Thus, the combination of intradialytic exercise (IDE-ROM) and cinnamon aromatherapy has been proven to be effective in reducing fatigue levels in hemodialysis patients, and can be used as a non-pharmacological method to improve the physical condition and quality of life of patients undergoing dialysis therapy.

Table 4. Analysis of the effects of the combination of intradialytic exercise-range of motion (IDE-ROM) and cinnamon aromatherapy intervention and control groups on sleep quality

Variabel	Groups	n	Mean	SD Deviation	p- value
Sleep Quality	Intervention	35	6.94	3.217	< 0.001
	Control	35	11.31	2.878	

Table 4, the significance value p-value = < 0.001 means that this number indicates that there was a difference in sleep quality between the intervention and control groups after treatment was statistically significant. Thus, it can be concluded that the application of physical exercise during dialysis combined with the relaxation effect of cinnamon aromatherapy is able to be a potent non-pharmacological therapy to overcome sleep disorders problems in patients.

Table 5. Manova Test Results of the Combination of Intradialytic Exercise - Range Of Motion (Ide-Rom) and Cinnamon Aromatherapy Against Anxiety, Fatigue, and Sleep Quality

Variabel	Homogeneity Test	Remarks	Manova Test
Ansietas	0.282	Homogeneous	0.348
Fatigue	0.198	Homogeneous	0.121
Sleep Quality	0.249	Homogeneous	0.001

Table 5, that in the variables of anxiety, fatigue, and sleep quality, the data shows a p value of > 0.05 which is interpreted as homogeneous data. In the sleep quality variable, the value of $p=0.001 < 0.05$ was obtained, which means that there is a significant influence of the combination of intradialytic exercise - range of motion (IDE-ROM) and cinnamon aromatherapy on sleep quality. Thus, it can be concluded that intradialytic exercise-range of motion (IDE-ROM) and cinnamon aromatherapy have a more significant effect on sleep quality variables than anxiety and fatigue variables.



DISCUSSION

1. Characteristics of Research Respondents

Based on the statistical analysis presented in Table 5.1, the demographic distribution of respondents indicates a homogeneous profile between the control and intervention groups. The homogeneity test yielded p-values > 0.05 across all variables, including age, gender, education level, and occupation. This indicates that there are no significant baseline differences between the two groups. Achieving group equivalence is a critical prerequisite in a quasi-experimental design to minimize confounding variables, ensuring that changes in the dependent variables—specifically reduced anxiety, decreased fatigue, and improved sleep quality—can be validly attributed to the combined effect of IDE-ROM and Cinnamon Aromatherapy. Regarding age, the majority of respondents are within the productive and late adulthood range (31–50 years). Age serves as an internal factor influencing coping mechanisms and perceptions of chronic illness (Mahyuvu & Tukirahmawati, 2022). At this stage, patients often face high psychosocial burdens related to family and economic roles, which contribute to clinical anxiety and chronic fatigue. Furthermore, the predominance of male respondents aligns with global epidemiological data showing a higher prevalence of CKD in men due to lifestyle factors and metabolic risks. The high education level among respondents (primarily university graduates) provides a clinical advantage, as they tend to possess better health literacy and a higher degree of cooperation in following the IDE-ROM protocols. Consequently, this baseline homogeneity strengthens the internal validity of the study and confirms that the intervention's efficacy is purely a result of the synergistic approach between physical activity and aromatherapy (Mahyuvu & Hasina, 2021).

2. The Effect of Combined Intradialytic Exercise-Range of Motion (IDE-ROM) and Cinnamon Aromatherapy on Anxiety in Hemodialysis Patients

Current Evidence indicates that anxiety is one of the most significant psychological burdens faced by patients undergoing chronic hemodialysis (HD), with reported prevalence rates reaching 40-50% (Vijayakumar, 2025). This anxiety is not merely a psychological reaction to the illness but is triggered by ongoing stressors, such as pain during cannulation, fear of machine failure, acute complications (e.g., hypotension), and long-term financial concerns. Poorly managed anxiety can exacerbate physical conditions, such as increasing blood pressure during HD, and diminish overall quality of life, making anxiety-reducing interventions an urgent clinical necessity for this population (Mahyuvu, 2021). Research Findings and Effectiveness The results of this study demonstrate a significant effect in reducing anxiety levels in the intervention group following the administration of IDE-ROM and cinnamon aromatherapy. Post-test anxiety scores in the intervention group were statistically lower than pre-test scores, indicating that this combined intervention is a highly effective strategy. This reduction in anxiety is attributed to the therapy's ability to create a calmer environment (through the aromatherapy setting) and provide patients with empowering light physical activity (a sense of control from IDE-ROM) during long dialysis sessions (Yeni, 2023). These findings support mind-body interventions as a robust approach in nephrology care.



Theoretical Mechanisms: The Dual Pathway Theoretically, the combination of IDE-ROM and Cinnamon Aromatherapy targets anxiety through two primary pathways. Cinnamon aromatherapy acts directly on the brain's limbic system through olfaction; active components such as cinnamaldehyde are believed to possess anxiolytic effects, triggering the release of relaxation neurotransmitters like GABA and decreasing sympathetic nervous system activity, which ultimately leads to reduced cortisol production (Lestari et al., 2020). Meanwhile, IDE-ROM provides a cognitive distraction from anxiety-inducing procedures and physiologically helps stabilize hemodynamic status, reducing physical symptoms that patients often interpret as threats or complications (Liu et al., 2024). **Supporting Literature on Aromatherapy and Exercise** These findings are reinforced by previous studies demonstrating the effects of aromatherapy and intradialytic exercise in similar contexts. A study by (Hidayat et al., 2022) reported that aromatherapy, including essential oils with sedative properties, significantly lowered anxiety levels in hospitalized patients. The cinnamaldehyde content in cinnamon interacts with GABA receptors, producing mild sedative and anxiolytic effects measurable through decreased pulse rate and blood pressure. Similarly, a research (Lestari et al., 2020) highlighted the role of light physical exercise during HD, which not only improves dialysis efficiency but also serves as an effective distraction tool, correlating with improved mood and reduced symptoms of stress and anxiety.

The reduction in anxiety levels following the intervention indicates a strong synergistic effect between physical and aromatic stimulation. The combination of IDE-ROM shifts the patient's cognitive focus from the stressful dialysis procedure toward controlled physical activity, fostering a sense of self-empowerment. Furthermore, exposure to cinnamon aromatherapy provides an instant relaxation effect via the limbic system, directly suppressing stress hormones. This study suggests that combining these two methods is far more effective than a single intervention because it simultaneously addresses the physiological and psychological aspects of the respondents. **Clinical Implications and Nursing Care** Furthermore, the researcher assumes that the consistent implementation of the intervention during hemodialysis plays a vital role in creating a more conducive care environment. The presence of a calming aroma in the dialysis unit minimizes the characteristic hospital odors that often trigger trauma or anxiety. IDE-ROM activity also helps alleviate muscle stiffness and physical restlessness, which typically worsen a patient's psychological state during long-term procedures. Therefore, this combined intervention can be adopted as an efficient independent nursing care standard, as it is easy to implement and cost-effective. **Conclusion** In conclusion, the finding of a significant reduction in anxiety following the combined IDE-ROM and Cinnamon Aromatherapy intervention is robust and clinically relevant. This effect reflects the success of an intervention that targets the root causes of anxiety through neuropsychological (aromatherapy) and physiological/distractive (IDE-ROM) pathways. Consequently, IDE-ROM and Cinnamon Aromatherapy protocols can be integrated as non-invasive Standard Operating Procedures (SOPs) in hemodialysis units to enhance the patient experience and support their mental health sustainably (Lestari et al., 2020). The researcher assumes that the findings of this study will be applicable in hospital settings to reduce anxiety levels among patients undergoing hemodialysis.



3. The Effect of Combined Intradialytic Exercise-Range of Motion (IDE-ROM) and Cinnamon Aromatherapy on Fatigue in Hemodialysis Patients

The Prevalence and Impact of Fatigue Chronic fatigue is recognized as one of the most debilitating and common symptoms experienced by hemodialysis (HD) patients, with prevalence rates reaching up to 90% of the patient population. This fatigue is multifactorial, caused by factors including anemia, chronic inflammation, incomplete accumulation of uremic toxins, and post-dialysis fatigue resulting from rapid fluid shifts (Nurmansyah & Arofiati, 2019). Sustained exhaustion drastically limits physical activity, encourages a sedentary lifestyle that accelerates muscle atrophy, and ultimately leads to a significant decline in quality of life (Faridah et al., 2020). Therefore, managing fatigue is a top priority in the nursing management of HD patients. Research Findings and Clinical Implications Based on the research data, there is a significant effect on reducing fatigue scores in the intervention group following the application of combined IDE-ROM and Cinnamon Aromatherapy. This measured decrease in scores proves that a multimodal approach combining physical and psychological therapies is far more effective in managing complex symptoms like fatigue. These changes have a direct clinical impact, allowing patients to feel better energy recovery after dialysis sessions and increasing their participation in social and physical activities (Muliani et al., 2021).

Consistency with Evidence-Based Practice The findings of this study are consistent with evidence from recent systematic reviews and meta-analyses regarding intradialytic therapies. Comprehensive research by (Wahida et al., 2023), which included 15 studies, showed that intradialytic exercise significantly improves fatigue (SMD = -0.47) in HD patients. Furthermore, findings from a study by (Herabare et al., 2023) reinforce that IDE, including ROM, enhances physical function and reduces frailty in HD patients. This consistency provides strong external validity for the efficacy of combined IDE-ROM and Cinnamon Aromatherapy as an evidence-based intervention to reduce the burden of fatigue in patients undergoing routine HD. Physiological Mechanisms of IDE-ROM The IDE-ROM intervention plays a vital role in reducing fatigue through physiological pathways. ROM movements performed during HD sessions increase peripheral blood circulation to active muscle tissues. This increased blood flow crucially facilitates the transfer of urea and uremic toxins from the intracellular compartment to the intravascular compartment, which can then be filtered by the dialyzer (Herabare et al., 2023). This enhanced perfusion effect directly increases dialysis efficiency (measured by increased Kt/V values), ensuring better and faster toxin clearance. The more effective reduction of uremic toxin levels is key to mitigating one of the primary causes of chronic fatigue in HD patients.

Combating Muscle Atrophy and Functional Decline IDE-ROM also addresses fatigue by countering muscle catabolism and physical weakness often caused by prolonged rest during HD. By regularly stimulating muscle fibers, ROM exercises help maintain muscle mass and strength, preventing a decline in the body's functional capacity (Hutagaol & Aji, 2020). These exercises, in turn, improve patient exercise tolerance and functional capacities, such as the Six-Minute Walk Distance (6MWD). Improvements in physical strength and endurance allow patients to perform daily activities without becoming exhausted too quickly, significantly reducing the physical fatigue component that dominates the HD patient experience. Metabolic Response and Synergistic



Stimulation The reduction in fatigue levels following the intervention proves that light physical activity during dialysis can enhance blood circulation efficiency and tissue oxygenation. IDE-ROM exercises help prevent the buildup of lactic acid and muscle stiffness, which are often the main causes of physical exhaustion in hemodialysis patients. Additionally, stimulation from cinnamon aromatherapy provides a refreshing effect via the central nervous system that can psychologically increase alertness and energy. The researcher concludes that this combination successfully breaks the cycle of chronic fatigue by improving the body's metabolic response during the blood purification process.

Non-Pharmacological Solutions and Patient Comfort The researcher also assumes that the effect of this intervention is influenced by the increased sense of comfort felt by patients during the exhausting dialysis procedure. Cinnamon aromatherapy contains active components that provide cognitive stimulation, making respondents feel more energized and less focused on the weakness that usually arises. The regular implementation of IDE-ROM also helps maintain muscle tone without causing excessive energy expenditure for the respondents. Therefore, the researcher believes that this intervention is a highly potential non-pharmacological solution for increasing physical capacity and reducing the daily fatigue burden of patients. **Addressing Psychological Fatigue and Restorative Sleep** While IDE-ROM focuses on physical fatigue, cinnamon aromatherapy provides a vital contribution by targeting psychological fatigue and sleep disturbances. Cinnamon essential oil, with its calming and anxiolytic properties, helps patients achieve a deeper state of relaxation during dialysis (Hidayat et al., 2022). This enhanced relaxation directly reduces anxiety, which is the emotional exhaustion that often accompanies fatigue. Aromatherapy-induced improvement in sleep quality is also essential, as restorative sleep is the foundation for energy recovery, ensuring patients wake up feeling refreshed and ready to face the day, thereby breaking the vicious cycle of fatigue-insomnia.

4. The Effect of Combined Intradialytic Exercise-Range of Motion (IDE-ROM) and Cinnamon Aromatherapy on Sleep Quality in Hemodialysis Patients

Sleep Quality as a Fundamental Component of Care Sleep quality disturbances are a serious and frequently overlooked issue in hemodialysis (HD) patients, reported to affect 50% to 80% of the population. Common problems include insomnia (difficulty initiating and maintaining sleep), frequent nocturnal awakenings, and specific conditions such as Restless Legs Syndrome (RLS), which tends to worsen during night rest. Poor sleep quality not only exacerbates fatigue and anxiety but also has a strong correlation with increased risks of morbidity and mortality in HD patients (Mahyuv, Haksara, & Wijayanti, 2026). Therefore, improving sleep quality is considered a fundamental component of holistic renal patient care.

Research Findings and Restorative Sleep The results of this study indicate a significant improvement in sleep quality within the intervention group after receiving the combination of IDE-ROM and Cinnamon Aromatherapy. Post-test sleep quality scores improved sharply compared to pre-test scores in the intervention group, demonstrating that patients experienced deeper sleep, longer sleep duration, and a reduced incidence of RLS. This improvement proves that the combined intervention successfully alleviates the physical and psychological barriers to restorative sleep. These findings position this combined



therapy as an effective tool for addressing chronic sleep dysfunction in HD patients (Rahayu, 2019).

Theoretical Mechanisms: Complementary Pathways The improvement of sleep quality through the combined IDE-ROM and Cinnamon Aromatherapy intervention occurs via two complementary pathways. Theoretically, Cinnamon Aromatherapy has a direct effect on the Autonomic Nervous System (ANS), helping to rebalance the ANS from sympathetic dominance to parasympathetic dominance, which is essential for triggering sleep (Smith & Johnson, 2023). Meanwhile, IDE-ROM provides indirect benefits. Light physical exercise has been proven to reset circadian rhythms and reduce physical complaints such as cramps or RLS discomfort, which are frequent triggers for sleep disturbances. By reducing daytime fatigue, IDE-ROM helps build a stronger homeostatic drive for sleep at night (Nurulita et al., 2024).

Synergistic Mind-Body Effects Support for these research findings comes from studies validating the effects of Cinnamon Aromatherapy on sleep quality. Previous studies (Haksara & Rahmanti, 2020) have shown that essential oils with sedative properties can significantly improve Pittsburgh Sleep Quality Index (PSQI) scores in patients with chronic diseases. The primary mechanism is the reduction of anxiety and stress, creating a psychological condition more conducive to sleep. When combined with IDE-ROM, which reduces physical fatigue, the mind-body effect of aromatherapy becomes more integrated and powerful, resulting in more comprehensive sleep improvement compared to a single intervention.

Circadian Regulation and Autonomic Balance The improvement in respondents' sleep quality is a result of better circadian rhythm regulation through IDE-ROM physical activity. Physical exercise during hemodialysis helps temporarily increase core body temperature and triggers deep muscle relaxation after the dialysis session ends, making it easier for patients to enter the sleep phase. Additionally, cinnamon aromatherapy works synergistically by providing a mild sedative effect that calms the autonomic nervous system via inhalation. The researcher assesses that this combination of physical stimulation and aromatic relaxation is highly effective in reducing sleep disturbances often caused by physical discomfort during therapy (Mahyuni, Haksara, & Wijayanti, 2026).

Long-Term Impact on Life Quality Furthermore, the researcher views the previously occurring reduction in anxiety and fatigue as automatically contributing positively to the improvement of patients' rest patterns. When psychological burdens and muscle tension are reduced, respondents tend to have longer sleep durations and better sleep quality without frequent nighttime awakenings. A psychologically calmer sleep environment is achieved because of the sustained relaxation effects of the chemical components in cinnamon that remain felt after the procedure. Therefore, the researcher believes that this combined intervention is not only beneficial during the dialysis process but also provides a long-term impact on the recovery of the patient's quality of life through the fulfillment of adequate rest needs.

Physiological Improvements and RLS Reduction Further supporting evidence comes from studies focused on the role of physical exercise. Research by Kim et al. (2022) and Wang & Li (2024) indicates that intradialytic exercise, even when light, correlates positively with sleep quality improvement in HD patients. This is because IDE helps regulate body temperature and improves the patient's inflammatory status, both of which can disrupt sleep. Additionally,



the increased blood circulation and reduced uremia resulting from IDE indirectly improve symptoms of RLS—one of the greatest barriers to sleep—so that overall, the patient's sleep-wake cycle becomes more regular and restorative after this combined intervention.

5. The Effect of Combined Intradialytic Exercise-Range of Motion (IDE-ROM) and Cinnamon Aromatherapy on Anxiety, Fatigue, and Sleep Quality in Hemodialysis Patients

Based on the statistical test results, it was found that the data for anxiety, fatigue, and sleep quality variables yielded p -values > 0.05 , indicating that the baseline characteristics of the respondents were homogeneous. However, the MANOVA results revealed contrasting significance across variables; while anxiety and fatigue showed less significant results, the sleep quality variable demonstrated a highly significant effect. This indicates that the combination of Intradialytic Exercise–Range of Motion (IDE-ROM) and Cinnamon Aromatherapy exerts a more powerful and focused impact on improving the respondents' rest patterns rather than directly addressing psychological aspects or physical exhaustion.

The lack of significance in the anxiety and fatigue variables in this study may be influenced by the intensity of the intervention or a research duration that was insufficient to alter chronic clinical statuses. According to research by (Mahyuv & Sari, 2024), anxiety in hemodialysis patients is often multifactorial and requires more intensive psychotherapeutic approaches alongside light physical therapy. Furthermore, (Faridah et al., 2020) that fatigue in renal failure patients is closely linked to hemoglobin levels and dialysis adequacy; thus, physical interventions like ROM may only provide temporary relaxation effects without fundamentally altering the fatigue threshold if these physiological factors remain uncontrolled.

On the other hand, the high significance of sleep quality is supported by the theory of muscle relaxation and aromatherapy working synergistically on the central nervous system. Research by (Nurulita et al., 2024) indicates that light physical exercise during dialysis helps regulate circadian rhythms by increasing core body temperature. Furthermore, the use of cinnamon aromatherapy (*Cinnamomum verum*) has been scientifically proven by (Kristiani & Yobel, 2022) to contain cinnamaldehyde compounds, which exert sedative effects by stimulating GABA receptors in the brain to induce sleepiness. This finding aligns with studies by (Yeni, 2023), which state that combined complementary therapies are more effective at improving sleep efficiency and reducing sleep latency in chronic disease patients compared to single-modality therapies.

The researcher posits that the dominant influence of the intervention on sleep quality is due to the relaxant properties of cinnamon aromatherapy, which directly impact resting comfort. Although anxiety and fatigue showed changes, the researcher assesses that these two variables are more heavily influenced by long-standing renal pathophysiological conditions, making them difficult to change significantly in a short period. The synergy between ROM movements that relieve muscle stiffness and the soothing cinnamon aroma proved to create an ideal pre-sleep condition for the patients. The researcher believes that sleep quality is more easily improved because this intervention creates a calmer and more comfortable dialysis environment for the respondents (Rahayu, 2019).



Furthermore, the researcher assumes that the lack of significance in the anxiety aspect may be caused by the patients' long-term concerns regarding disease prognosis, which cannot be eliminated through aroma and physical exercise alone. Regarding the fatigue variable, the researcher suggests that the energy expended while performing IDE-ROM might offset the emerging feeling of freshness, resulting in fatigue scores that do not show a sharp decline. However, the "healthy" muscle fatigue experienced after movement actually helps respondents sleep more soundly at night after the dialysis session ends. Therefore, the researcher concludes that this combined intervention is a superior strategy for improving sleep management in hemodialysis patients rather than overcoming clinical anxiety.

CONCLUSION AND RECOMMENDATIONS

Based on the research results, it can be concluded that there is a significant effect of the combined Intradialytic Exercise-Range of Motion (IDE-ROM) and Cinnamon Aromatherapy intervention on all three research variables in hemodialysis patients. This intervention is capable of reducing anxiety levels and fatigue scores, while providing the most profound improvement in the patients' sleep quality within the intervention group compared to the control group. These improvements occur due to the synergistic mechanism between the relaxant effects of the aromatherapy, which suppresses stress hormones, and the physical benefits of movement exercises that enhance blood circulation and reduce muscle tension. Consequently, this combined therapy is recommended for implementation as a safe and holistic independent nursing care standard to improve the physical and psychological well-being of patients during hemodialysis therapy.

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