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Complementary Therapies To Reduce Fatigue In Hemodialysis Patients: A Scoping Review Of Randomized Controlled Trials

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Abstract

Fatigue is one of the most common symptoms experienced by hemodialysis patients and has a negative impact on their quality of life, functional ability, and psychological condition. This scoping review aims to map the latest scientific evidence on the effectiveness of complementary therapies in reducing fatigue among hemodialysis patients based on Randomized Controlled Trials (RCTs) published between 2020 and 2025. The review followed the Joanna Briggs Institute (JBI) and PRISMA-ScR guidelines. Literature searches were conducted across five databases (PubMed, ProQuest, Sage Journals, BMC Journals, and Google Scholar) using MeSH-based keywords and Boolean operators. Inclusion criteria included RCTs involving hemodialysis patients aged ≥18 years, interventions involving complementary therapies such as physical exercise, massage, acupressure, relaxation, humor, or digital-based interventions, and fatigue as the primary outcome. From 3,355 identified articles, eight studies met the inclusion criteria and were further analyzed. Thematic synthesis identified six complementary interventions consistently effective in reducing fatigue: intradialytic physical exercise, olive oil massage, acupressure combined with Qur'anic murrotal recitation, relaxation techniques (autogenic, deep breathing, Benson), humor therapy, and digital recreational therapy. All interventions reported statistically significant reductions in fatigue ($p < 0.05$) and improvements in psychological well-being and patient comfort. Complementary therapy shows strong potential as a safe, low-cost, and effective non-pharmacological strategy to alleviate fatigue in hemodialysis patients. Further research is recommended to assess long-term effectiveness, develop standardized operational procedures, and explore implementation within Indonesian healthcare contexts.

Keywords: Fatigue; Hemodialysis; Complementary Therapy; Physical Exercise; Relaxation

1. INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive and irreversible condition characterized by a gradual decline in kidney function over a minimum period of three months. In advanced stages, patients often require renal replacement therapy, such as hemodialysis or transplantation, to sustain life [1]. The rising prevalence of CKD and the increasing demand for hemodialysis have become significant public health issues in Indonesia, where the prevalence of CKD reaches 0.38% and approximately 60% of patients require dialysis as the primary therapy [2]. Although hemodialysis can prolong patients' life expectancy, the procedure often imposes substantial physical, psychological, and social burdens, with one of the main complaints being fatigue, which significantly affects patients' quality of life [3].

Fatigue in hemodialysis patients is a complex clinical phenomenon influenced by various physiological, psychological, and social factors. The pathophysiology of fatigue involves reduced oxygen supply to tissues due to anemia, impaired energy metabolism, accumulation of metabolic waste products, and decreased erythropoietin production [4]. In addition to physiological factors, dialysis duration, intradialytic hypotension, sleep disturbances, low physical activity, and limited social support further exacerbate fatigue symptoms [5][6][7]. The clinical consequences of fatigue include decreased physical capacity, limitations in daily activities, impaired concentration and motivation, increased risk of depression, and social isolation, which collectively reduce patients' quality of life and adherence to hemodialysis therapy.

Fatigue is one of the most common and distressing symptoms in patients undergoing hemodialysis, with reported prevalence ranging from 20% to 91%, particularly as patients'

clinical conditions deteriorate [4]. Fatigue is characterized by weakness, decreased energy, cognitive impairment, and difficulty concentrating, significantly affecting daily activities [8]. This condition is often associated with reduced erythropoietin production leading to anemia, decreased tissue oxygen delivery, and impaired cellular metabolism. Additional factors such as tissue hypoxia, lactic acidosis, protein-energy wasting, hyperphosphatemia, and depression further exacerbate fatigue [4]. Hemodialysis patients may experience two forms of fatigue: intradialytic fatigue, which occurs during the procedure, and post-dialytic fatigue, which arises after the procedure. These two forms can reinforce each other and lead to chronic fatigue, with 60 to 80% of patients reporting increased fatigue during hemodialysis sessions [9]. The impact of fatigue is extensive, including reduced physical functioning, dependence in daily activities, psychological disturbances, decreased energy and motivation, and an increased risk of social isolation and depression [10]. Cumulatively, fatigue can diminish quality of life, increase the risk of complications, and affect the life expectancy of hemodialysis patients [11].

Field observations indicate a lack of structured and evidence-based nursing interventions to reduce fatigue in hemodialysis patients. Several local studies have evaluated interventions such as Progressive Muscle Relaxation, intradialytic physical exercises like Range of Motion, and nursing education [3][12][13]. Although these studies reported positive outcomes, they have limitations, including small sample sizes, short intervention durations, a focus on a single type of intervention, and insufficient consideration of the holistic integration of patients' physical, psychological, and spiritual aspects. The identified research gaps include: first, the absence of a systematic mapping of complementary nursing interventions for fatigue in hemodialysis patients in Indonesia; second, a lack of comprehensive analysis of recent literature from 2020 to 2025; and third, most studies have not employed a guideline-based scoping review approach, such as the JBI framework, to thoroughly assess the effectiveness of interventions [14]. These gaps highlight an urgent need for scientific studies that integrate various forms of non-pharmacological nursing interventions to effectively and holistically reduce fatigue. The urgency of this study is high, as unaddressed fatigue can exacerbate medical complications, reduce therapy adherence, disrupt patients' psychosocial functioning, and significantly impair quality of life. With the increasing prevalence of CKD and the substantial burden of hemodialysis services, evidence-based nursing interventions are critically needed to enhance patient well-being, support therapy adherence, and prevent long-term complications.

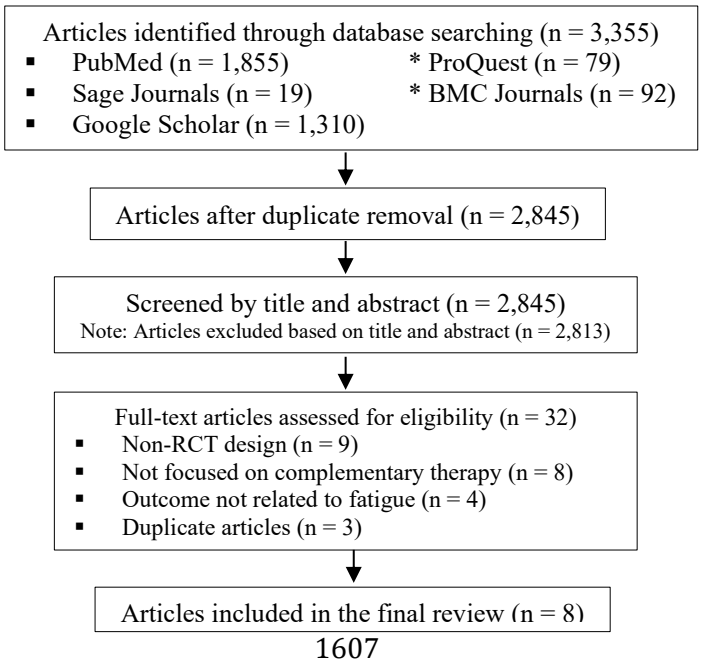
Based on the identified problems, observed phenomena, and research gaps, this study aims to conduct a scoping review of recent literature (2020-2025) on non-pharmacological nursing interventions to reduce fatigue in hemodialysis patients. This review will map the types of interventions, implementation methods, duration, and effectiveness, thereby providing recommendations for systematic, evidence-based, and holistic nursing practice to improve the quality of life of hemodialysis patients.

2. RESEARCH METHODS

This study was conducted as a *scoping review* following the methodological framework of the Joanna Briggs Institute [15] and the PRISMA-ScR reporting guidelines [16]. The scoping review design was chosen to allow a broad and comprehensive mapping of the scientific evidence within an emerging and heterogeneous topic that has not been extensively reviewed systematically. The review was guided by the Population–Concept–Context (PCC) framework, with hemodialysis patients as the *Population*, complementary therapy as the *Concept*, and healthcare settings such as hospitals and dialysis clinics as the *Context*. The research question was formulated as: "What complementary therapies have been proven effective in reducing fatigue among hemodialysis patients based on the latest scientific evidence?".

A comprehensive literature search was performed across five major electronic databases PubMed, ProQuest, Sage Journals, BMC Journals, and Google Scholar for studies published between 2020 and 2025. The final search was conducted on September 27, 2025. The search strategy employed a combination of Medical Subject Headings (MeSH) and free-text terms, including "fatigue," "hemodialysis," "complementary therapy," "exercise," "massage," "relaxation," and "randomized controlled trial," combined using Boolean operators "AND" and "OR." No geographical restrictions were applied; however, the review was limited to articles published in English and Indonesian. A total of 3,355 articles were identified 1,855 from PubMed, 79 from ProQuest, 19 from Sage Journals, 92 from BMC Journals, and 1,310 from Google Scholar. The inclusion criteria were: (1) studies with a randomized controlled trial (RCT) design; (2) adult hemodialysis patients; (3) interventions involving complementary therapies such as physical exercise, massage, acupressure, relaxation, humor, or digital-based interventions; (4) primary outcome measuring fatigue levels; and (5) full-text articles published in English or Indonesian. Exclusion criteria included observational studies, non-systematic reviews, case reports, and study protocols. After removing duplicates, screening titles and abstracts, and conducting full-text assessments, eight articles met the eligibility criteria.

The selection process was independently performed by two reviewers to minimize assessment bias. Both reviewers screened the articles separately, and disagreements were resolved through discussion until consensus was reached. This procedure ensured objectivity and consistency in the article selection process. Data from eligible studies were extracted using the Joanna Briggs Institute Data Charting Form, which included author, publication year, study design, sample characteristics, type of therapy, intervention duration, and main outcomes. Data were analyzed using thematic–narrative synthesis, grouping results into six main themes: (1) physical exercise; (2) massage and acupressure; (3) relaxation; (4) humor therapy; (5) recreational therapy; and (6) combined approaches. A thematic mapping was also performed to identify intervention patterns, effect consistency, and research gaps. Of the eight studies reviewed, 75% were conducted in Asian countries (Indonesia, Iran, India, and China) and 25% in Europe. The intervention duration ranged from 4 to 12 weeks, with physical exercise (37.5%) and massage (25%) being the most frequently investigated therapies. All interventions demonstrated statistically significant reductions in fatigue ($p < 0.05$). The entire reporting process adhered to the PRISMA-ScR checklist. Figure 1, Article Selection Flow Diagram Based on PRISMA-ScR



3. RESULT AND DISCUSSION

3.1. Result

Through a systematic literature selection process, eight articles were identified that met the predetermined inclusion and exclusion criteria. These studies were then subjected to a detailed data extraction process following the guidelines of the Joanna Briggs Institute (JBI) to ensure methodological consistency and transparency. The comprehensive results of the data extraction are presented in table 1.

Table 1. JBI Data Charting Form - Summary of Reviewed Articles (2020-2025)

Author (Year)	Country	Study Design	Sample	Type of Intervention	Intervention Duration	Main Outcome (Outcome & Key Findings)
Salehi et al. (2020)	Iran	RCT	37 HD patients (20 intervention, 17 control)	Intradialytic mini cycle exercise (20 minutes, 2×/week, 30 rpm)	3 months + 1 month follow up	Fatigue decreased significantly in the intervention group from 58.80 to 54.23 ($p = 0.001$), while in the control group fatigue increased from 62.53 to 70.34. Mini-cycle exercise was effective for long term fatigue reduction.
Lazarus et al. (2021)	India	RCT	200 HD patients (100 intervention, 100 control)	Olive oil massage on the back and lower limbs before and during hemodialysis	8 weeks (each HD session 4 hours)	Significant reduction in fatigue ($p < 0.001$); 36% of the intervention group reported no fatigue vs. 73% of the control group reporting severe fatigue. Massage therapy effectively reduced fatigue and improved energy levels.
Hibatullah et al. (2023)	Indonesia	RCT	34 HD patients (17 intervention, 17 control)	Acupressure on points CV-4, ST-36, SP-36, GV-20 (8–10 minutes) + Qur'anic recitation (15–20 minutes via audio)	2 weeks (2×/week, 4 sessions)	FACIT-Fatigue improved from 19.53 (severe fatigue) to 34.35 (mild-moderate fatigue) in the intervention group ($p = 0.001$). Combined acupressure + Qur'anic recitation

Author (Year)	Country	Study Design	Sample	Type of Intervention	Intervention Duration	Main Outcome (Outcome & Key Findings)
						effectively reduced physical and spiritual fatigue.
Utami et al. (2022)	Indonesia	RCT	40 HD patients (20 autogenic relaxation, 20 deep breathing)	Autogenic relaxation and deep breathing exercises	2 weeks (each session 15-30 minutes)	Both interventions significantly reduced fatigue levels ($p < 0.001$). No significant difference between groups ($p > 0.66$). Both relaxation. techniques were clinically and statistically effective in reducing fatigue among hemodialysis patients.
Alishahi et al. (2024)	Iran	RCT	72 HD patients (36 intervention, 36 control)	Smartphone-based recreational therapy (music, comedy, educational games)	8 weeks, 30 minutes/day	MFI-20 scores decreased significantly in the intervention group ($p < 0.001$) across all fatigue dimensions. Therapy also improved energy, activity, and motivation.
Sahebkar et al. (2024)	Iran	RCT	66 HD patients (33 intervention, 33 control)	Humor therapy (funny videos and stories; 60 minutes/session)	3 weeks, 2×/week	Fatigue scores significantly decreased weekly ($p < 0.001$). Humor therapy effectively reduced emotional fatigue and improved mood.
Nuryanti et al. (2024)	Indonesia	RCT	32 HD patients (16 intervention, 16 control)	Combined Qur'anic recitation + Benson relaxation during hemodialysis	4 weeks, 2×/week	Fatigue decreased from 48.13 to 41.88 in the intervention group ($p = 0.000$), whereas the control group increased from 46.63 to 48.44.

Author (Year)	Country	Study Design	Sample	Type of Intervention	Intervention Duration	Main Outcome (Outcome & Key Findings)
						The combined intervention reduced fatigue and increased calmness.
Nakoui et al. (2025)	Iran	RCT	51 HD patients (17 resistance, 17 aerobic, 17 control)	Resistance exercise (50 minutes) and aerobic exercise (30 minutes) outside HD sessions	8 weeks, 3×/week	Fatigue decreased significantly: resistance group from 37.29 to 27.17; aerobic group from 38.94 to 29.00; control group increased slightly (39.58 to 39.76). Both resistance and aerobic exercise effectively improved physical fitness and reduced fatigue.

Source: Compiled from reviewed RCT studies (2020-2025) based on JBI Data Charting Form

Based on the extraction results of the eight selected studies that met the inclusion criteria, a thematic analysis was performed to classify the types of complementary therapy interventions applied to hemodialysis patients. This analytical process resulted in the identification of six major thematic categories of interventions that were consistently reported across the reviewed studies. These categories include: (1) physical exercise, which encompasses intradialytic and post-dialytic training programs; (2) massage and acupressure, emphasizing tactile stimulation to improve circulation and relaxation; (3) relaxation techniques, involving autogenic training, deep breathing, and Benson's relaxation method; (4) humor therapy, focusing on emotional stimulation and mood regulation; (5) recreational therapy, incorporating digital or interactive activities to enhance engagement during dialysis sessions; and (6) combined approaches, which integrate physical, psychological, and spiritual components to provide a more holistic intervention. Together, these themes reflect a diverse and multidimensional approach to fatigue management in hemodialysis patients, aligning with the holistic philosophy of nursing care.

Table 2. Thematic Mapping of Complementary Therapy Interventions among Hemodialysis Patients

Main Theme	Associated Interventions	Number of Studies	Summary of Findings
Physical Exercise	Intradialytic mini-cycle exercise; resistance and aerobic training	2	Significantly reduced fatigue levels and improved physical endurance and functional capacity; benefits were sustained up to one month after intervention.

Main Theme	Associated Interventions	Number of Studies	Summary of Findings
Massage and Acupressure	Olive oil massage; acupressure	2	Effectively alleviated fatigue by enhancing peripheral circulation and inducing physiological relaxation.
Relaxation	Autogenic relaxation; deep breathing; Benson relaxation	2	Decreased perceived fatigue and promoted autonomic balance; improved sleep quality and comfort during hemodialysis sessions.
Humor Therapy	Funny videos and humorous storytelling	1	Reduced psychological fatigue and enhanced positive mood and emotional well-being.
Recreational Therapy	App-based activities (music, comedy, educational games)	1	Improved psychological engagement, motivation, and multidimensional aspects of fatigue.
Combination Approaches	Qur'anic recitation combined with Benson relaxation	1	Demonstrated synergistic physical–spiritual benefits in reducing fatigue and enhancing tranquility and inner calmness.

Source: Adapted from Lazarus et al. (2021); Hibatullah et al. (2023); Alishahi et al. (2024); Sahebkar et al. (2024); Nakoui et al. (2025).

All complementary therapy interventions reviewed demonstrated a statistically significant reduction in fatigue levels ($p < 0.05$) among hemodialysis patients. Interventions that integrated physical, psychological, and spiritual components yielded broader and more sustained effects compared to single-component therapies. However, notable research gaps remain regarding the long-term efficacy of interventions exceeding three months and the comprehensive evaluation of psychosocial dimensions, including quality of life, emotional adaptation, and patient engagement during hemodialysis.

3.2. Discussion

Based on the literature review, eight articles were identified that met the inclusion criteria and were relevant to the research question. These articles originated from various countries, predominantly from Asian regions such as Iran, India, and Indonesia. Sample sizes in each study ranged from 32 to 200 participants, with variations in demographic characteristics as well as inclusion and exclusion criteria. The interventions investigated were diverse, including physical exercise, massage, acupressure, Al-Qur'an recitation (murottal), app-based recreational therapy, humor therapy, and relaxation techniques. All studies reported the effectiveness of these interventions in reducing fatigue levels among hemodialysis patients.

Physical Exercise

Physical exercise is the most commonly implemented complementary intervention to reduce fatigue in hemodialysis patients. This activity includes light aerobic exercise, resistance training, and intradialytic exercises using a mini-cycle or range of motion movements. The primary physiological mechanisms involve increased muscle mass and strength, improved tissue perfusion, enhanced oxygen transport, and optimized cellular energy metabolism. Psychologically, physical exercise stimulates the release of neurotransmitters such as endorphins, dopamine, and serotonin, which help regulate mood, reduce perceived fatigue, and improve sleep quality. Additionally, intradialytic exercise enhances dialysis efficiency,

including urea and creatinine clearance, indirectly reducing the accumulation of metabolic waste products that trigger fatigue. These psychological effects further lower fatigue perception and improve sleep quality, allowing patients to feel more refreshed during daily activities [17].

The study by Nakoui et al., (2025) demonstrated a reduction of approximately 10 points on the Fatigue Severity Scale (FSS) after an eight-week intradialytic exercise program, with a p-value of 0.001, indicating statistically and clinically significant effects. This intervention also improved functional capacity, patients' motivation to engage in movement, and energy levels during daily activities [18]. Intradialytic exercise is an effective, safe, and feasible intervention for reducing fatigue both physiologically and psychologically. The success of the exercise depends on its duration, intensity, and patient adherence. Intradialytic exercise represents an effective strategy as it does not require additional time beyond the dialysis session.

Massage Therapy

Massage is a complementary intervention with significant potential to reduce fatigue in hemodialysis patients due to its muscle-relaxing and circulation-enhancing effects. Techniques such as olive oil massage, administered before hemodialysis and repeated hourly during the procedure (approximately 4 hours) over eight weeks, using effleurage and kneading movements with light to moderate pressure, help relax tense muscles and improve blood and lymphatic flow [19]. This process facilitates the removal of metabolic waste from tissues, thereby reducing feelings of fatigue. In addition, stimulation of the parasympathetic nervous system lowers cortisol levels and increases endorphin and serotonin production. These effects provide psychological comfort, reduce stress, and decrease perceived fatigue [20].

From a psychological perspective, massage also provides significant benefits by reducing cortisol levels and stimulating the release of endorphins and serotonin, hormones involved in stress regulation, mood, and emotional well-being. A systematic review indicated that massage therapy, including back massage, foot massage, and aromatherapy combinations, not only reduced fatigue scores but also alleviated anxiety and improved sleep quality in hemodialysis patients [21]. Furthermore, another literature review found that routine foot reflexology can decrease fatigue in hemodialysis patients through neural reflex mechanisms and parasympathetic nervous system stimulation [22].

Based on this evidence, massage emerges as a relatively simple and low-cost intervention, particularly in hemodialysis clinic settings or even at home. Its effectiveness is optimized when performed regularly, for example, before or during dialysis sessions, by trained healthcare professionals or family members with basic training. The advantage of massage over other interventions lies in its ability to simultaneously address physiological and psychological aspects without requiring sophisticated equipment. Massage is a complementary intervention that effectively reduces fatigue in hemodialysis patients through physical and emotional mechanisms; it is safe, inexpensive, and easily integrated into dialysis routines, making it a highly viable component of a comprehensive nursing care protocol.

Acupressure

Acupressure is a complementary intervention used to reduce fatigue in hemodialysis patients by stimulating specific acupuncture points through manual pressure. This intervention operates via physiological and neurohormonal mechanisms, including increased local blood flow, parasympathetic nervous system stimulation, and modulation of neurotransmitters with endorphin release, which collectively reduce the perception of fatigue [23]. Effective acupressure protocols typically last 15 to 20 minutes per session, conducted 2 to 3 times per week for 4 to 8 weeks, with standardized pressure (3 to 4 kg) to ensure intervention consistency.

Validation of acupuncture points by trained practitioners ensures accurate and safe stimulation for patients. Beyond physiological effects, acupressure provides significant psychological benefits. Stimulation of acupressure points can reduce anxiety, enhance emotional comfort, and improve sleep quality in hemodialysis patients. Studies have shown that patients receiving regular acupressure report significant reductions in Fatigue Severity Scale (FSS) scores compared to control groups, along with improved mood and motivation to engage in daily activities [24]. This mechanism aligns with the mind–body interaction concept, wherein sensory stimulation modulates subjective perceptions of fatigue through neurohormonal pathways.

Acupressure is particularly effective for patients experiencing chronic fatigue or mobility limitations because it is non-invasive, safe, and does not require sophisticated equipment. The success of the intervention depends on accurate point location, consistent frequency, and session duration. Compared to other interventions, acupressure has the advantage of simultaneously providing physiological and psychological benefits, helping patients feel more refreshed and better able to participate in hemodialysis therapy.

Recreational Therapy

Digital app-based recreational therapy is an emerging complementary intervention aimed at reducing fatigue in hemodialysis patients. This intervention involves light recreational activities, including educational games, light physical exercises, music content, and comedy films, accessible via smartphones or tablets. Its physiological mechanisms include light activity stimulation that enhances blood circulation and muscle mass, helping to reduce muscle weakness and accumulation of metabolic waste [25]. Additionally, recreational activities promote the release of neurotransmitters such as dopamine and serotonin, which play a role in mood regulation, stress reduction, and decreased fatigue perception.

Psychologically, recreational therapy provides significant positive effects. Patients report increased emotional comfort, motivation, and improved sleep quality after regularly participating in digital recreational sessions. The intervention also enhances social interaction among patients when conducted in groups or through community features within the app. A trial by Alishahi et al. (2024) demonstrated that patients using the recreational app for at least 30 minutes per day over eight weeks experienced significant reductions in Fatigue Severity Scale (FSS) scores compared to the control group [25]. These effects were observed not only in reduced fatigue perception but also in increased participation in daily activities and adherence to hemodialysis sessions.

Digital app-based recreational therapy is flexible, easily accessible, and adaptable to patient conditions, including those with limited mobility. Its success depends on consistent use, patients' ability to operate the app, and support from healthcare providers or family members. The advantage of this therapy over conventional interventions lies in its ability to simultaneously integrate physical, psychological, and social stimulation, thereby supporting the holistic well-being of hemodialysis patients.

Humor Therapy

Humor therapy is a complementary intervention that reduces fatigue in hemodialysis patients through psychological and physiological stimulation. This intervention involves activities that induce laughter, such as watching comedy content, interactive games, or group sessions facilitated by healthcare professionals. Its physiological mechanisms include increased release of endorphins, dopamine, and serotonin, hormones involved in mood regulation, stress reduction, and fatigue perception [26]. Laughter also enhances pulmonary ventilation, muscle relaxation, and blood circulation, helping to alleviate physical tension and fatigue.

Psychologically, humor therapy improves emotional comfort, motivation, and social interaction among patients. Randomized controlled trials have shown that humor therapy sessions conducted twice weekly for 60 minutes over three weeks significantly reduced Fatigue Symptom Inventory scores compared to control groups [26]. These findings align with Bennett et al. (2020), who reported that laughter therapy enhances overall health and reduces fatigue in hemodialysis patients [27]. Humor therapy is a flexible, safe, and easily implemented intervention in both clinical and home settings. Its effectiveness depends on session regularity, patient participation, and healthcare support. The advantage of humor therapy over other interventions lies in its simultaneous physical and psychological effects, improving mood and supporting patient adherence to hemodialysis therapy.

Relaxation Techniques

Relaxation is a complementary mind–body therapy intervention that effectively reduces fatigue in hemodialysis patients. One widely used technique is the Benson Relaxation Technique, which combines deep breathing with the repetition of meaningful phrases to activate the parasympathetic nervous system, suppress sympathetic activity, and lower cortisol levels [28]. Its physiological mechanisms include increased blood flow, tissue oxygenation, reduced muscle tension, and neurotransmitter modulation, all of which help decrease the perception of fatigue. This intervention is typically administered twice daily or in several sessions per week over 4 to 8 weeks, depending on study protocols. Beyond physiological effects, relaxation provides significant psychological benefits. Patients report reduced anxiety, stress, and depressive symptoms, along with improved sleep quality following routine relaxation programs [29]. Combining relaxation techniques with Al-Qur'an recitation (murottal) has also been shown to enhance fatigue reduction, indicating that integrating spiritual interventions can strengthen psychological and emotional benefits for hemodialysis patients [28].

Relaxation is a safe and simple intervention that can be performed at home or in dialysis facilities. Its success depends on the regularity of practice, patient motivation, and support from healthcare professionals. This intervention can be combined with other therapies, such as light physical exercise or music therapy, for synergistic effects. The advantage of relaxation over other interventions lies in its non-invasive nature, lack of requirement for specialized equipment, and ability to simultaneously provide physiological and psychological benefits.

Fatigue in hemodialysis patients is a multifactorial symptom that significantly impacts quality of life, functional capacity, and patient adherence to therapy [30][31]. Progressive kidney dysfunction leads to the accumulation of uremic toxins, anemia, and muscle weakness, all of which contribute to the perception of fatigue. Therefore, routine monitoring using valid and reliable instruments, such as the MFI-20, IFS, PFS, or FSS, is essential to objectively assess patients' fatigue levels and to tailor nursing interventions appropriately [32]. Fatigue in hemodialysis patients is influenced by muscle weakness, anemia, and the accumulation of toxins due to decreased renal filtration function [30]. The majority of chronic kidney disease (CKD) patients experience fatigue, which can exacerbate clinical conditions and reduce quality of life [31]. Therefore, routine monitoring using instruments such as the Multidimensional Fatigue Inventory (MFI-20), Integrated Fatigue Scale (IFS), Piper Fatigue Scale (PFS), or Fatigue Severity Scale (FSS) is essential. Several studies included in this review indicate that various interventions including acupressure, massage, physical exercise, humor therapy, relaxation, and digital-based therapies are effective in reducing fatigue through both physiological and psychological mechanisms [32].

Various complementary interventions, including acupressure, massage, physical exercise, relaxation, humor therapy, and digital-based recreational therapy, have been shown to

reduce fatigue through distinct physiological and psychological mechanisms. The implementation of these interventions requires careful consideration of costs, resources, healthcare provider competencies, and sustainability, as some techniques, such as acupressure, require professional certification to prevent adverse effects [33]. Simple and safe interventions, such as olive oil massage or light physical exercise, can be administered by nurses or family members following adequate education, whereas digital therapies require appropriate devices and patient technical skills [34][35]. Intradialytic exercise offers additional advantages because it can be performed concurrently with dialysis sessions, does not extend treatment duration, and allows direct monitoring by nurses. Meta-analyses indicate that this intervention is safe and enhances dialysis efficiency without increasing adverse events [36]. Overall, the selection and implementation of interventions should be individualized, taking into account patients' clinical conditions, preferences, and facility capabilities. This holistic approach not only reduces fatigue but also improves quality of life, motivation, and adherence to hemodialysis therapy, thereby contributing significantly to the long-term success of care for patients with chronic kidney disease.

4. CONCLUSION

Fatigue is a multifactorial and highly prevalent symptom among hemodialysis patients, significantly affecting physical capacity, psychological well-being, motivation, and adherence to therapy. Its causes involve progressive kidney dysfunction, anemia, accumulation of toxins, muscle weakness, and altered energy metabolism, as well as psychological and social factors such as stress, anxiety, depression, limited social support, and reduced engagement in daily activities. Unmanaged fatigue not only diminishes quality of life but may also compromise clinical outcomes by reducing treatment adherence and increasing vulnerability to complications. Complementary nursing interventions have been shown to effectively reduce fatigue through both physiological and psychological mechanisms. Physical exercise, including aerobic, resistance, and intradialytic modalities, improves muscle strength, tissue perfusion, and energy metabolism while stimulating neurotransmitter release to enhance mood and reduce perceived fatigue. Massage and acupressure provide combined physiological and psychological benefits by improving circulation, relaxing tense muscles, activating the parasympathetic nervous system, modulating neurohormonal activity, and promoting emotional comfort. Relaxation techniques, including deep breathing, guided imagery, and integration with spiritual practices, activate the parasympathetic system, lower stress hormone levels, and improve sleep quality, thereby reducing fatigue and supporting emotional well-being. Humor therapy and digital recreational interventions enhance positive affect, motivation, and social engagement, offering accessible, low-cost, and flexible options for patients with varying mobility and clinical limitations.

The success of these interventions depends on patient-specific factors such as clinical condition, mobility, motivation, and personal preferences, as well as the resources and skills available in the healthcare setting. Interventions like intradialytic exercise can be incorporated into routine dialysis sessions, allowing real-time monitoring without extending treatment time. Structured and holistic programs that combine multiple complementary approaches provide synergistic benefits by comprehensively addressing fatigue while enhancing physical, psychological, and social well-being. Overall, complementary nursing interventions for fatigue in hemodialysis patients are safe, effective, and practical, and they should be considered essential components of patient-centered care. By reducing fatigue, improving quality of life, increasing motivation, and supporting adherence to therapy, these interventions contribute significantly to the long-term clinical outcomes and overall well-being of patients undergoing

hemodialysis. Future research should focus on optimizing intervention protocols, evaluating long-term effects, and integrating multimodal strategies into routine nursing practice to ensure sustainable and holistic care for this vulnerable population.

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