Review Article

doi:10.31674/mjn.2024.v16i01.030

MJN

Sustainable Impact of Intradialytic Exercise and Cognitive Behavior Therapy on the Quality of Life of Patients with Chronic Kidney Disease: A Non-Pharmacological Approach

Akhmad Huda[1,2]*, Faridah Mohd. Said[2], Jayasree S. Kanathasan[3], Fidrotin Azizah[1], Dwi Agung Susanti[1], Sofyan Hadi Hasibuan[1]

[1]Sekolah Tinggi Ilmu Kesehatan Rajekwesi Bojonegoro, Jl. KH. Moch. Rosyid KM. 05 Ngumpakdalem, Dander, Bojonegoro, East Java 62171, Indonesia

[2]Faculty of Nursing, Lincoln University College, Wisma Lincoln, No. 12-18, Jalan SS 6/12, 47301 Petaling Jaya, Selangor Darul Ehsan, Malaysia

[3]Faculty of Applied Science, Lincoln University College, Wisma Lincoln, No. 12-18, Jalan SS 6/12, 47301 Petaling Jaya, Selangor Darul Ehsan, Malaysia

**Corresponding Author's Email: ahmadhuda764@gmail.com*

ABSTRACT

Chronic kidney disease (CKD) affects a person's psychological and physical health, which lowers their quality of life. Hemodialysis is a common kind of replacement treatment for patients with chronic renal disease. The data on symptoms is expanding as the need to manage symptoms in advanced chronic kidney disease (CKD) patients receiving hemodialysis (HD) becomes more widely recognized. Finding non-pharmacological ways to improve CKD patients' quality of life was the goal of this study. A brief overview of the existing research on non-pharmacologic therapies aimed at improving symptoms and enhancing quality of life in dialysis patients with advanced chronic kidney disease is provided in this study. Not only are there no clinical practice guidelines available to treat those frequent symptoms, but there is also a dearth of research about the best ways to integrate symptom intervention techniques into clinical care. According to the present review research, this combination of physical and cognitive behavioral intervention may be employed as a non-pharmacological technique to limit physical and cognitive decline and improve quality of life in the HD population. This suggests a promising direction for further research and application in HD care.

Keywords: Intradialytic Exercise; Cognitive Behaviour Therapy; Quality of Life; Chronic Kidney Disease

INTRODUCTION

Chronic kidney disease (CKD) is defined as kidney damage or an estimated glomerular filtration rate <60 mL/min/1.73 m^2 that lasts for three months or more, regardless of the etiology. Over the past three decades, there has been a dramatic increase in the global burden of chronic kidney disease (CKD), with 43.1% undergoing dialysis and 77.5% receiving kidney replacement therapy for end-stage kidney disease (ESKD). A total of 89% of ESKD patients worldwide (HD) receive treatment through hemodialysis. In people with severe chronic kidney disease (CKD), symptoms such as pain, tiredness, insomnia, muscle cramps, restless legs, itching, nausea, and vomiting, cognitive impairment, anxiety, and depression are the most prevalent and/or annoying symptoms (Chowdhury & Kumar, 2023).

Over months or years, a variety of diverse disease pathways can lead to chronic kidney disease (CKD), which is characterized by irreversible changes to the kidney's structure and function (Liu *et al*., 2022). Furthermore, chronic kidney disease (CKD) and cardiovascular disease (CVD) are strongly correlated; these two major diseases continue to be the primary causes of morbidity and early death in this patient population (Liyanage *et al.*, 2022). So, CKD is a global health issue that requires additional clinical research and

Received: May 10, 2024 Received in revised form: June 21, 2024 Accepted: June 26, 2024

development in order to improve medicines and reduce rates of morbidity and death (Bitan *et al*., 2019).

With a high medical cost burden, poor clinical outcomes, and a continually rising prevalence, chronic kidney disease (CKD) has emerged as a major global public health concern (Apel *et al*., 2021). Globally, CKD affects between 8% and 16% of people, often misdiagnosed by doctors and patients (Chen, Knicely & Grams, 2019). There are about 26 million adult Americans and 4.6 million adult Koreans with chronic kidney disease (CKD). The yearly medical costs per person associated with CKD were $1,700 for stage 2,$3,500 for stage 3, and $12,700 for stage 4 (Park *et al*., 2021).

The diagnosis and treatment of chronic kidney disease (CKD) can significantly impact a patient's everyday life, leading to multiple losses and limits that may cause a variety of biopsychosocial changes (Hagemann *et al*., 2018), which may significantly impact the patient's quality of life (QOL), including the physical and mental component scales (PCS and MCS) (Salhab *et al*., 2019). For a dialysis CKD patient, QOL is defined as the patient's subjective assessment of their level of well-being, which can range from contentment to dissatisfaction, concerning aspects of their life that hold significance to them (Hagemann *et al*., 2018). According to Khatib *et al*. (2018), studies measuring the impact of sickness, cost-effectiveness analyses, and healthcare quality have highlighted QOL as a critical health outcome. There is a considerable increased risk of hospitalization and death with lower QOL ratings (Ravera *et al*., 2021) because it changes how the individual perceives and evaluates life and the illness, which may cause to not adhere to treatment (Hagemann *et al*., 2018).

According to Lagadec *et al*. (2018), patients with early HD have lower physical strength, muscle metabolism, peak oxygen consumption (VO2 peak), and with a higher chance of death. As a result, their quality of life (QOL) declines. Gomes Neto *et al*. (2018) added that CKD patients receiving hemodialysis still report lower levels of daily physical activity, lower exercise tolerance, worse health-related quality of life, and functional impairment compared to people in the general population of similar ages, despite improvements in treatment.

This narrative review tried to give a short summary of the evidence (such as systematic reviews of clinical trials and observational studies) about cognitive behavior therapy and exercise during dialysis in order to show which symptoms people with advanced chronic kidney disease (CKD) on HD most often experience. Evidence of non-pharmacologic therapies that adopt a holistic approach to symptom management was studied. Patients with severe chronic kidney disease (CKD) undergoing long-term dialysis were assessed.

Impact of Hemodialysis on Quality of Life

Person's emotional, social, and physical well-being, as well as their capacity to engage in day-to-day activities determine quality of life, with a score ranging from 0 to 50 (Negara *et al*., 2019). According to Yoon *et al*. (2018), a person's quality of life is a measure of the benefits that may be inferred from their lives. One can often evaluate an individual's quality of life by looking at the physical, psychological, social, and environmental aspects of his existence (Chwaszcz *et al*., 2020). Quality of Life is a concept that examines an individual's ability to live a normal life based on their perceptions of goals, expectations, and standards, as well as their specific attention to life as influenced by the values and culture of the environment in which they live (Şahin, Ozer, & Yanardag, 2019). The state of one's health has an impact on one's quality of life. The better one's health, the better one's quality of life (Devlin *et al*., 2018).

Several factors contribute to this, including personal characteristics, prior experience, and coping mechanisms. Each dimension has its own impact on life satisfaction (Briggs, Davies, & Wilkie, 2019). Anxiety that can surface both before and during treatment can have a detrimental effect on a patient's quality of life (QOL) if they have chronic kidney disease. Hemodialysis therapy is costly, time-consuming, and necessitates dietary and hydration restrictions. Long-term dialysis treatment alone frequently causes loss of independence, reliance on caregivers, disarray in social, marital, and family life, as well as a decrease or elimination of income. These factors have a detrimental impact on life's physical, psychological, socioeconomic, and environmental facets, which lowers QOL (Ravindran *et al.*, 2020).

For patients with HD, regular hospital or dialysis centre visits—typically three times per week—require complicated procedures that significantly alter the patients' daily routines. A significant symptom burden is

possible for 92% of HD patients, who may also have debilitating symptoms such as cramping in their muscles, edoema in their hands and feet, decreased appetite, and weariness that negatively impact their quality of life (Thenmozhi, 2018). Long-term dialysis results in a loss of independence and dependence on a caregiver. HD is a time-consuming, expensive treatment that requires additional dietary and hydration restrictions. Each of these elements lowers QOL (Thenmozhi, 2018).

Based on the given explanations, it can be deduced that an individual's assessment of their position in life, within their culture and value system, considering their personal goals, standards, expectations, and worries, determines their quality of life. Patients with HD experience a wide range of symptoms, including exhaustion, decreased appetite, difficulty concentrating, edoema in the hands and feet, cramping in the muscles, and a heavy financial load that negatively impacts their quality of life.

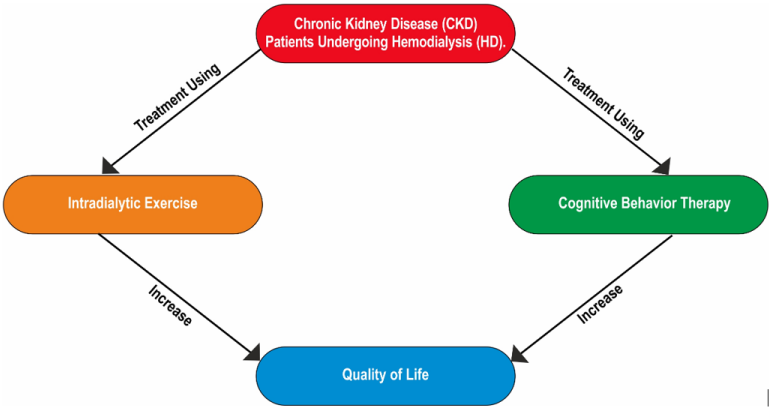

Figure 1: Intradialytic Exercise: A Nonpharmacological Management for CKD Patients

Intradialytic Exercise

A patient undergoing hemodialysis performs intradialytic exercise (Mohamed, Kanona, & El-Gahsh, 2020). In this context, intradialytic exercise refers to a planned and structured physical activity that enhances and sustains physical fitness (López-Torres *et al*., 2021). Intradialytic exercise has great value in improving physical health and quality of life for chronic kidney disease patients undergoing hemodialysis (Fauzi & Triaswati, 2021). Doctors, nurses, and patients can start exercise with the best therapy for existing complaints with good cooperation.

Pu *et al*. (2019) systematic review and meta-analysis provide convincing proof of the safety and effectiveness of intradialytic exercise for patients receiving maintenance hemodialysate (MHD). Thirteen studies concentrated on resistance training, four on aerobic training, and the remaining seven on a mix of resistance and aerobic training. The specific workout routines used in each study were different. It was seen that intradialytic exercise may help MHD patients' depression, quality of life, Kt/V (is a measure of dialysis adequacy), and exercise ability, in addition to lowering their blood pressure.

Lin *et al*. (2021) provided similar explanations, demonstrating that a 12-week intradialytic exercise programme is both safe and effective way may enhance Health-related quality of life and lowering depression levels in hemodialysis patients. A study by Kirkman *et al*. (2019) reported that supervised light to moderate intradialytic aerobic cycling may help with phosphate elimination and could be used as an extra treatment for patients who aren't meeting therapeutic phosphate goals. The impact of intradialytic exercise on Kt/V urea and other intermediate molecules and protein-bound solutes must be further investigated.

Types of Intradialytic Exercise in Hemodialysis Patients

There are 3 types of intradialytic exercise for regular hemodialysis patients: flexibility exercise, strengthening exercise, and cardiovascular exercise (Mayes, Koufaki, & Greenwood, 2023). Intradialytic exercise at the flexibility exercise stage helps joints work smoothly and helps to bend muscles, touch, and move

objects more easily. Flexibility exercises are composed of smooth muscle stretching and slow movements. Strength training uses resistance (weights, elastics, bands, and the patient's own weight) to make muscles stronger. Cardiovascular exercise helps the heart, lungs, and body circulation work more efficiently. Mayes, Koufaki, and Greenwood (2023) suggest that cardiovascular exercise involves resistance, rhythm, hand, or foot movements.

Cardiovascular exercise, also known as aerobic exercise, improves the heart's, lungs', and circulation's ability to work more efficiently. The arms or legs hold the rhythmic movements in place. The goal of this exercise is to increase endurance. Aerobic exercise is a type of intradialytic exercise that involves stimulating the heart, blood circulation, and breathing for a long period of time in order to improve the body's benefits (Grigoriou *et al*., 2022). Aerobic exercise enhances the body's oxygen utilization that is performed at a low to moderate intensity for a longer period of time (Margolis *et al*., 2021). It seen that arterial resistance, pulse wave velocity, improved clinically with intradialytic exercise programming. A number of physiological indicators of cardiovascular function got better in people with chronic kidney disease (CKD). These included diastolic blood pressure, left ventricular ejection fraction, and heart rate variability as measured by the low-frequency/high-frequency ratio (Verrelli *et al.*, 2024).

Pu *et al*. (2019) demonstrated the advantages of intradialytic exercise in terms of enhancing depression, exercise ability, hemodynamic adequacy, and quality of life. Rhee *et al*. (2019) found that intradialytic exercise training during dialysis was beneficial for depression in terms of mental health, physical health status, and intradialytic hypotension. Additionally, Suhardjono *et al*. (2019) discovered that intradialytic exercise regimens considerably raised the quality-of-life index as well as the strength of the lower extremities' muscles. Furthermore, Chung, Yeh, and Liu (2017) study's findings make it easier to choose intradialytic exercise that improves and offers safety in terms of peak oxygen consumption, hemoglobin, depression, and the physical aspect of quality of life.

People with end-stage kidney disease on peritoneal dialysis (PD) are often inactive and frail. A study tested the feasibility of a combined resistance and cardiovascular exercise program for PD patients at a dedicated home dialysis center. The results suggest such a program is feasible and safe, and it is recommended that PD therapy providers include exercise programs managed by professionals to mitigate physical decline in PD patients (Bennett *et al*., 2020).

Effect of Intradialytic Exercise

To maintain physical fitness, one must engage in intradialytic exercise on a regular basis. The side effects of intradialytic exercise include the following:

Cardiovascular Response

During hemodialysis, exercise stimulates skeletal muscle fibers, including sympathetic nerves. Vasoconstriction of peripheral blood vessels and stimulation of cardiac muscle activity are two of these responses. Aji, Yetti & Sukmarini, 2020, suggested that increased cardiac output and blood flow in the lower extremities, along with capillary widening, can facilitate the excretion of toxins for cleaning during dialysis. The reduction in diastolic blood pressure may also be around 5–10%. Intradialytic exercise can lead to a 10–20% increase in cardiac output. Resting and exercise heart rates may decrease, leading to a 10-20% reduction in resting heart rate and lower heart rates during exercise. Cardiovascular endurance and exercise capacity may improve, with some individuals experiencing a 10–30% increase in exercise duration or workload (Aji, Yetti, & Sukmarini, 2020).

Respiratory Response

Intradialytic exercise will cause rapid breathing, increased body temperature, increased epinephrine levels, and stimulation of muscle joint receptors. As a result of increased blood flow to the working muscles, they will get additional oxygen. Intradialytic exercise will increase lung diffusion capacity, making the breathing process deeper and more efficient. Furthermore, intradialytic exercise helps the body get adequate oxygen intake. This is because oxygen plays a very important role in respiration and circulation. Oxygen that blends with the blood that flows throughout the body will remove toxins and metabolic waste, increasing the

body's metabolism. The maximum amount of oxygen entering the body maximizes energy production, thereby reducing fatigue levels (Utami *et al.*, 2022). Intradialytic exercise can lead to improved lung function, including increased lung capacity and better ventilation. This improvement can vary, but it might be in the range of 5–15% in lung function tests like forced vital capacity (FVC) or forced expiratory volume in one second (FEV1). This improvement can vary, but it might be in the range of 5–15% in lung function tests like forced vital capacity (FVC) or forced expiratory volume in one second (FEV1). The increase in VO2 max may range from 5-20%, depending on the exercise intensity and duration (Utami *et al.*, 2022).

Toxic Release Response

For patients with kidney disease, the dialysis process is critical for cleaning up toxic waste. Intradialytic exercise helps to increase muscle stretch, which increases cardiac output and stimulates excretory function, effectively removing urea from the blood during the hemodialysis process (George, 2019).

Benefits of Intradialytic Exercise

Some of the benefits of intradialytic exercise include: 1) is useful for strengthening the respiratory muscles so as to facilitate the flow of air in and out of the lungs; 2) expanding and strengthening the heart muscle; 3) improving circulation and blood pressure; 4) increasing the number of red blood cells; and 5) improving mental health, including reducing stress and fatigue levels (Andrade *et al*., 2019).

Other benefits of intradialytic exercise include improved oxygenation, aerobic capacity, physical function, and dialysis efficacy, as well as a decrease in arterial stiffness and, in certain trials, a lower incidence of Ischemic Heart Disease (IHD) (Penny *et al*., 2019).

Regular resistance training and breathing exercises are part of the rehabilitation program. Resistance training will enhance the muscle activity. Physical activity during HD sessions alleviates circulation stasis and facilitates solute elimination by enhancing blood flow, muscle strength, and the outflow of urea and other toxins into the vascular compartment for elimination. Patients with Chronic Renal Failure (CRF) is benefited from exercise because it improves arterial stiffness, lowers pulse pressure, and increases oxygen diffusion, all of which support aerobic capacity (Wayan, 2021).

Intradialytic Exercise Procedure

The definition of intradialytic exercise itself states that the intervention process takes place during the patient's hemodialysis session. According to, Kim, Park, and Yang (2022) it is prescribed to give intradialytic exercises during the first hour of hemodialysis and repeating them every 4 to 6 weeks, with each session lasting 10 to 20 minutes. Rochmawati, Utomo, and Makiyah (2022) found that 4 weeks of intradialytic exercise can reduce complications in patients undergoing hemodialysis. Strength training is one type of physical activity that hemodialysis patients which must be performed on a regular basis (Wilund, Jeong, & Greenwood, 2019). By fighting resistance forces, strength training makes muscles stronger and works harder. Other physical abilities rely on muscle strength. According to Martins do Valle *et al.* (2020) research, stretching exercise can improve respiratory muscle strength, functional capacity, and quality of life in hemodialysis patients. Aerobic exercise has demonstrated a reduction in the symptoms of restless legs syndrome (RLS) (Franco *et al*., 2019). Franco *et al.* (2019) conducted a review of 19 papers to evaluate the effectiveness of physical exercise in treating sleep-related movement disorders (SRMD) in both human and animal models. However, the majority of the research utilized aerobic exercise. There have been three studies assessing the effectiveness of combination exercise, but none examining the role of resistance exercise. Two studies using animal models illustrate how physical exercise alters the dopaminergic system, while another study investigates the relationship between exercise practice and the release of beta-endorphin. According to Lu, Wang, and Lu (2019), implementing aerobic exercise has the result of increasing muscle strength in hemodialysis patients. Yang *et al.* (2021) conducted additional research that revealed the use of aerobic exercise with the combination of deep breathing techniques and progressive muscle relaxation may help hemodialysis patients avert complications. Deep breathing and progressive muscle relaxation lower systolic and diastolic blood pressure, as well as headaches, muscle cramps, nausea, and vomiting complications.

Salhab *et al.* (2019) suggested implementing intradialytic exercise through aerobic activity. There was a

decrease in fatigue, urea, and blood pressure, according to the study. The following are examples of intradialytic exercise procedures:

1. Full wrist flexion, eight times per minute
2. Full elbow flexion, eight times per minute.
3. Ankle rotation clockwise eight times per minute.
4. Ankle rotation in anti-clockwise direction eight times per minute.
5. Full flexion of the ankle eight times per minute.

Cognitive Behavioral Therapy: A Non-pharmacological Management for CKD Patients

Cognitive behavioral therapy (CBT) is a psychotherapeutic approach that manages dysfunctional emotions, behaviors, and knowledge through a systematic procedure (Gerogianni, Kouzoupis, & Grapsa, 2018). Cognitive Behavior Therapy (CBT) is defined as an integrated set of behavioral and cognitive interventions, guided by applied science concepts. Behavioral treatments aim to decrease maladaptive behaviors and enhance adaptive ones by modifying the precursors and outcomes of harmful behaviors, as well as the behavioral practices that facilitate new learning. The aim of cognitive therapies is to alter unhelpful thoughts, self-statements, or beliefs. CBT is characterized by problem-focused intervention techniques that are based on principles from both cognitive theory and learning theory (Otte, 2011).

The psychological theory that underpins cognitive behavioral therapy (CBT) holds that people's perceptions of events have a greater impact on their emotional, behavioral, and physiological responses than the actual circumstances. Furthermore, when psychopathology is present, people's interpretations may be skewed, false, or useless. People frequently connect these interpretations, sometimes known as "automatic thoughts," to underlying, maladaptive ideas about the world, themselves, other people, or the future. Beck and Fleming (2021) found that their patients felt better and were able to modify their behavior when they helped them examine and correct their false beliefs. The patients' improvements continued after they addressed and altered their core ideas.

The Development of Cognitive Therapy

Cognitive Therapy was able to improve patients' feelings of well-being and encourage more adaptive behavior by assisting them in addressing negative information processing biases. Researchers discovered that cognitive therapy, also known as cognitive behavior therapy, or CBT, can help individuals with medical issues. CBT can often aid in symptom reduction. In some situations, CBT can assist patients in managing their ailments more effectively. Studies have demonstrated the benefits of cognitive behavioral therapy (CBT) for individuals with a wide range of illnesses, including dementia, sleeplessness, irritable bowel syndrome, migraine headaches, obesity, and chronic pain (Beck & Fleming, 2021).

Cognitive-Behavioral Therapy for Haemodialysis Patients

Depression is common in Chronic Kidney Disease (CKD) and linked to poorer outcomes, yet evidence on effective interventions is limited. Nonpharmacological interventions, especially Cognitive Behavioural Therapy, showed significant effects on depressive symptoms, though implementation in routine care remains unclear. A study highlights the need for better-quality trials and the development of CKD-specific guidelines for managing depression (Pearce *et al.*, 2024). Another study showed that depressive disorders are common among dialysis patients, increasing mortality and hospitalization rates. Despite this, psychological intervention programs are lacking. A meta-analysis evaluated the impact of cognitive-behavioral therapy (CBT) on depressive symptoms in dialysis patients, hypothesizing its effectiveness. A systematic search identified four studies with 226 patients, showing that CBT significantly reduced depression symptoms (mean difference = –5.3, $p = 0.001$). The findings suggest that integrating CBT with renal replacement therapy could improve mental health outcomes for dialysis patients (Zegarow *et al.*, 2020). CBT has the potential to enhance depressive symptoms and quality of life in hemodialysis patients with coexisting depressive symptoms. However, more robust research is required because the current studies are limited in number and vary in methodological quality (Ling *et al.*, 2020).

DISCUSSION

It is clear from the above study that Intradialytic Exercise and Cognitive Behavior Therapy have a very positive impact on the quality of life of patients with chronic kidney disease. Patients with Chronic Kidney Disease who undergo hemodialysis always experience some painful health issues.

The Effectiveness of Intradialytic Exercise in Quality of Life (QOL) During Hemodialysis

Gomes Neto *et al*. (2018) used a systematic review and meta-analysis to investigate the effects of several intradialytic exercise training regimens on the physical functioning and health-related quality of life of maintenance hemodialysis patients. The results revealed that therapies that improve physical functioning and quality of life in people with end-stage renal disease who are on hemodialysis by combining aerobic and resistance training during dialysis.

Salhab *et al*. (2019) conducted a comprehensive review and meta-analysis to investigate the effectiveness of aerobic IDE therapies in terms of quality of life (QOL), blood phosphorus, dialysis efficiency, inflammatory status, vitamin D3, parathyroid hormone, phosphate binder intake, mortality, and hospitalization rate. Therefore it is seen that IDE did not put hemodialysis patients' health at risk.

In order to determine the quality of life specific to kidney diseases, measure frailty, and ask participants about their typical passive and active intradialytic activities (such as watching TV or sleeping), Warsame *et al*. (2018) conducted a cross-sectional study involving 431 hemodialysis patients. A prospective investigation involving a larger group of hemodialysis patients validated these outcomes. Dialysis providers can consider offering extra assistance and opportunities for patients with low activity levels to participate in healthy intradialytic activities.

Muliani, Muslim, and Abidin (2021) investigated the impact of intradialytic exercise flexibility on fatigue levels in individuals undergoing hemodialisis. The therapy involved 15 minutes of physical activity per training session, repeated eight times over a period of four weeks. A *t*-test was used to analyze the data, which revealed that intradialytic exercise and flexibility had a positive influence on tiredness levels in CKD patients receiving haemodialysis.

Pu *et al*. (2019) conducted a meta-analysis and systematic review to evaluate the safety and effectiveness of intradialytic exercise in patients receiving hemodialysis. Intradialytic exercise demonstrated improvements in depression, exercise capacity, hemodialysis adequacy, and quality of life among hemodialysis patients.

Mathew and Latsha (2014) observed that exercise training benefits hemodialysis patients by improving their fitness, physical function, and overall quality of life. Health professionals should properly treat patients suffering from tiredness to prevent future complications.

Ortega-Pérez de Villar *et al*. (2020) carried out a pilot study to evaluate the impact on HD patients of 16 weeks of ID exercise against an HB exercise program. Both therapies led to positive changes in physical function and levels of physical activity. On the other hand, the exercise regimen was successful in improving certain QOL domains and physical capabilities.

Maniam *et al*. (2014) conducted a quasi-experimental study to determine the effectiveness of a practiced low-to-moderate-intensity exercise program in reducing weariness and improving sleep disruptions in long-term haemodialysis patients. This research found that basic low-to-moderate-intensity exercise may help haemodialysis patients reduce weariness, sleep issues, and improve their overall quality of life.

Huang *et al.* (2020) conducted a randomized controlled trial to investigate the effects of 24-week combined exercise on blood pressure, exercise capacity, hemodialysis efficiency, and quality of life in patients undergoing hemodialysis. The interaction of combined exercise and intervention time impacted hemodialysis efficiency. For hemodialysis patients, combined exercise increased physical fitness and blood pressure without affecting quality of life. The numerous advantages of combined exercise support the development of exercise programs for hemodialysis patients.

In order to determine the impact of leg exercise during hemodialysis on patients' levels of fatigue and daily

activities, Ibrahim, and Mokhtar (2018) conducted research at the Aswan University Hospital hemodialysis unit. A simple physical exercise regimen was found to be safe and useful along with clinical nursing intervention for hemodialysis patients to lessen fatigue and improve daily activities and quality of life.

Grover *et al.* (2022) conducted a pilot study on the process of intradialytic exercises (IDE) that affect the maximum amount of oxygen consumed and the quality of life for Indian patients on hemodialysis. From pre- to post-intervention, IDE demonstrated a statistically significant difference in their maximal oxygen consumption and quality of life, as well as an improvement in their sleep quality. The IDE significantly improved the patient's maximal oxygen consumption, sleep quality, quality of life, and fatigue over a 12-week period.

Kim, Park, and Yang (2022) conducted a study to evaluate the impact of an intradialytic aerobic exercise program on the frailty, quality of life, and dialysis adequacy of hemodialysis patients. For hemodialysis patients, an intradialytic aerobic exercise program may be a safe, practical, and acceptable adjunct to normal care to improve frailty, dialysis adequacy, and quality of life.

According to research by Rochmawati, Utomo, and Makiyah (2022), twice-weekly range-of-motion exercises can enhance the quality of life and adequacy of dialysis for patients receiving hemodialysis. The study yielded significant improvements in quality of life, particularly in the areas of renal disease symptoms and effects. Patients receiving hemodialysis may benefit from an intervention that incorporates ROM into their care to enhance their quality of life and the adequacy of their dialysis.

Krase *et al*. (2022) looked at how seven months of intradialytic exercise training (IDE) affected the structure of the vastus lateralis (VL) muscle, its ability to do its job, and the patients' quality of life. Intradialytic aerobic exercise therapy preserves thigh muscle mass in HD patients while improving functional abilities. Muscle ultrasonography appears to have a significant role in assessing changes in muscle quality in individuals receiving hemodialysis.

It is clear from the above discussion that intradialytic exercise has a profound effect on patients' quality of life while receiving hemodialysis.

The effectiveness of cognitive behavioral therapy during hemodialysis is a topic of interest.

Shirazian *et al*. (2018) conducted a pilot randomized controlled trial protocol designed to evaluate the viability and impact of a cognitive behavioral intervention on the quality of life of hemodialysis patients. Research has demonstrated that CB-based therapies significantly enhance patients' health-related quality of life (HRQOL). In spite of this, clinical practice has not consistently included these therapies. The suggested intervention is easily transferable to other HD units and has the potential to enhance self-management and HRQOL.

Sohn *et al.* (2018) created and implemented a group cognitive behavioral therapy (CBT) program that included mindfulness meditation for patients with end-stage renal disease (ESRD) undergoing HD. Changes in QOL were assessed. In this pilot trial, a CBT program that incorporated mindfulness meditation improved biochemical marker levels and overall mental health in ESRD patients undergoing HD.

Solati *et al*. (2018) conducted descriptive research, randomly selecting fifty hemodialysis patients at Hajar Hospital and dividing them into two groups: the experimental group and the control group. The study's findings demonstrated that hemodialysis patients' mean quality of life and self-efficacy scores increased after participating in the Mindfulness-Based Cognitive Therapy (MBCT) program.

Ng *et al.* (2019) conducted a systematic review and meta-analysis of randomized controlled trials involving cognitive behavioral therapy for depression in hemodialysis patients. This meta-analysis aimed to assess the effectiveness of cognitive behavioral therapy (CBT) for hemodialysis patients with concomitant depression and determine if intervention can improve other elements such as anxiety and quality of life. This meta-analysis suggested that cognitive behavioral therapy (CBT) may be useful in lowering anxiety and depressive symptoms, as well as enhancing quality of life in hemodialysis patients who also have comorbid depression.

Liao *et al*. (2020) investigated the effect of comprehensive nursing interventions that altered hemodialysis patients' negative emotions, quality of life, and renal function. Comprehensive nursing interventions can improve hemodialysis patients' quality of life and renal function by reducing anxiety and sadness.

Ling *et al*. (2020) conducted a comprehensive evaluation of the impact of cognitive behavioral therapy on depression and quality of life in patients receiving maintenance hemodialysate. Furthermore, there was no discernible change in QOL scores between CBT and sertraline; however, CBT appears to be helpful in enhancing QOL when compared with normal treatment. When HD patients have co-occurring depressive symptoms, CBT may help with depressive symptoms and quality of life.

A Randomized Controlled Trial (MEITRA Study) was carried out by Zhianfar *et al*. (2020) in two hemodialysis wards of the Shahrvand hospital, which is situated in Sari, the provincial capital of Mazandaran, in northern Iran. All ESRD-AQ subscale mean score changes for the attendees in the intervention group followed the same pattern of statistically significant changes.

Valsaraj *et al*. (2021) conducted a randomized controlled experiment on 67 CKD patients who visited a tertiary multispeciality hospital in India. These findings demonstrate that CBT is superior to non-directive counselling in terms of enhancing treatment adherence and physiological and clinical parameters in hemodialysis patients with chronic kidney disease.

CONCLUSION

Patients with HD need psychosocial assistance to minimise medicinal nonadherence. It can be said that the present study highlights the interaction between physical exercise and cognitive training and their effects on both cognitive and physical performance in HD patients. This study also demonstrated the feasibility of incorporating new cognitive activity during dialysis for those with HD. The findings could pave the way for developing guidelines and routines for physical and cognitive training aimed at improving both cognitive and physical performance, thereby enhancing the quality of life for individuals. This combined intervention of physical and cognitive activities may serve as a non-pharmacological approach to prevent physical and cognitive decline in the HD population and improve their quality of life, as indicated by this review study. This opens a promising direction for future research and application in HD treatment.

Conflict of Interest

The authors declare that they have no competing interests.

ACKNOWLEDGEMENT

The authors are thankful to the institutional authority for completion of the work.

REFERENCES

Aji, Y. G. T., Yetti, K., & Sukmarini, L. (2020). The Six-Minute Walking Exercise on The Fatigue Levels in Hemodialysis Patients. *Puinovakesmas, 1*(1), 25-31. https://doi.org/10.29238/puinova.v1i1.435

Andrade, F. P., Rezende, P. D. S., Ferreira, T. D. S., Borba, G. C., Müller, A. M., & Rovedder, P. M. E. (2019). Effects of intradialytic exercise on cardiopulmonary capacity in chronic kidney disease: systematic review and meta-analysis of randomized clinical trials. *Scientific Reports, 9*(1), 18470. https://doi.org/10.1038/s41598-019-54953-x

Apel, C., Hornig, C., Maddux, F. W., Ketchersid, T., Yeung, J., & Guinsburg, A. (2021). Informed decision-making in delivery of dialysis: combining clinical outcomes with sustainability. *Clinical Kidney Journal, 14*(Supplement_4), i98-i113. https://doi.org/10.1093/ckj/sfab193

Beck, J. S., & Fleming, S. (2021). A brief history of Aaron T. Beck, MD, and cognitive behavior therapy. *Clinical Psychology in Europe, 3*(2). https://doi.org/10.32872/CPE.6701

Bennett, P. N., Hussein, W. F., Matthews, K., West, M., Smith, E., Reiterman, M., ... & Schiller, B. M. (2020). An exercise program for peritoneal dialysis patients in the United States: a feasibility study. *Kidney Medicine, 2*(3), 267-275. https://doi.org/10.1016/j.xkme.2020.01.005

Bitan, D. T., Krieger, I., Berkovitch, A., Comaneshter, D., & Cohen, A. (2019). Chronic kidney disease in adults with schizophrenia: a nationwide population-based study. *General Hospital Psychiatry, 58*, 1-6. https://doi.org/10.1016/j.genhosppsych.2019.01.007

Briggs, V., Davies, S., & Wilkie, M. (2019). International variations in peritoneal dialysis utilization and implications for practice. *American Journal of Kidney Diseases, 74*(1), 101-110. https://doi.org/10.1053/j. ajkd.2018.12.033

Chen, T. K., Knicely, D. H., & Grams, M. E. (2019). Chronic kidney disease diagnosis and management: a review. *Jama, 322*(13), 1294-1304. https://doi.org/10.1001/jama.2019.14745

Chowdhury, G. R., & Kumar, Y. (2023). Non-pharmacological Intervention Approaches for Common Symptoms in Advanced Chronic Kidney Disease Patients on Haemodialysis: Narrative Review. *Indian Journal of Continuing Nursing Education, 24*(2), 133-138. https://doi.org/10.4103/ijcn.ijcn_93_22

Chung, Y. C., Yeh, M. L., & Liu, Y. M. (2017). Effects of intradialytic exercise on the physical function, depression and quality of life for haemodialysis patients: a systematic review and meta-analysis of randomised controlled trials. *Journal of Clinical Nursing, 26*(13-14), 1801-1813. https://doi.org/10.1111/jocn.13514

Chwaszcz, J., Palacz-Chrisidis, A., Wiechetek, M., Bartczuk, R., Niewiadomska, I., Wośko, P., & Sławska, P. (2020). Quality of life and its factors in the COVID19 pandemic situation. Results of Stage 1 studies during the pandemic growth period. *KUL: Lublin, Poland*. https://doi.org/10.3390/ijerph19106023

Devlin, N. J., Shah, K. K., Feng, Y., Mulhern, B., & Van Hout, B. (2018). Valuing health-related quality of life: An EQ-5 D-5 L value set for England. *Health Economics, 27*(1), 7-22. https://doi.org/10.1002/hec.3564

Fauzi, A., & Triaswati, R. (2021). The effect of intradialytic stretching training on restless legs syndrome and sleep quality in hemodialysis patients. *Korean Journal of Adult Nursing, 33*(1), 37-43. https://doi.org/10.7475/kjan. 2021.33.1.37

Franco, B., Daubian-Nosé, P., De-Mello, M. T., & Esteves, A. M. (2019). Exercise as a favorable non-pharmacologic treatment to Sleep-Related Movement Disorders: a review. *Sleep Science, 12*(02), 116-121. https://doi.org/10.5935/1984-0063.20190064

George, C. (2019). Caring for Patients Receiving Peritoneal Dialysis: Part I. *Medsurg Nursing, 28*(4). https://openurl.ebsco.com/EPDB%3Agcd%3A8%3A3754568/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A138187885&crl=c accessed . Accessed on 7th January, 2024.

Gerogianni, G., Kouzoupis, A., & Grapsa, E. (2018). A holistic approach to factors affecting depression in haemodialysis patients. *International Urology and Nephrology, 50*, 1467-1476. https://doi.org/10.1007/s11255 - 018-1891-0

Gomes Neto, M., de Lacerda, F. F. R., Lopes, A. A., Martinez, B. P., & Saquetto, M. B. (2018). Intradialytic exercise training modalities on physical functioning and health-related quality of life in patients undergoing maintenance hemodialysis: systematic review and meta-analysis. *Clinical Rehabilitation, 32*(9), 1189-1202. https://doi.org/10.1177/0269215518760380

Grigoriou, S. S., Karatzaferi, C., Giannaki, C. D., Patramani, G., Vogiatzi, C., Mitrou, G. I., ... & Sakkas, G. K. (2022). The effect of a 9-month hybrid intradialytic exercise training program on nerve conduction velocity parameters in patients receiving hemodialysis therapy. *International Urology and Nephrology, 54*(12), 3271-3281. https://doi.org/10.1007/s11255-022-03266-6

Grover, S., Goyal, V., Chorsiya, V., Ganguly, N. K., & Saha, G. K. (2022). Effect of intradialytic exercises (IDE) on

maximal oxygen consumption and quality of life undergoing hemodialysis in Indian population—a pilot study. *Bulletin of Faculty of Physical Therapy, 27(*1), 27. https://doi.org/10.1186/s43161-022-00086-8

Hagemann, P. D. M. S., Martin, L. C., & Neme, C. M. B. (2018). The effect of music therapy on hemodialysis patients' quality of life and depression symptoms. *Brazilian Journal of Nephrology, 41*, 74-82. https://doi.org/10.1590/2175-8239-jbn-2018-0023

Huang, M., Lv, A., Wang, J., Zhang, B., Xu, N., Zhai, Z., ... & Ni, C. (2020). The effect of intradialytic combined exercise on hemodialysis efficiency in end-stage renal disease patients: a randomized-controlled trial. *International Urology and Nephrology, 52*, 969-976. https://doi.org/10.1007/s11255-020-02459-1

Ibrahim, M., & Mokhtar, I. (2018). Leg exercise: effect on reducing fatigue and improving activities of daily living for hemodialysis patients. *IOSR Journal of Nursing and Health Science, 7*(3), 11-19. http://dx.doi.org/10.9790/1959-0703041119

Khatib, S. T., Hemadneh, M. K., Hasan, S. A., Khazneh, E., & Zyoud, S. E. H. (2018). Quality of life in hemodialysis diabetic patients: a multicenter cross-sectional study from Palestine. *BMC Nephrology, 19*, 1-9. https://doi.org/10.1186/s12882-018-0849-x

Kim, S., Park, H. J., & Yang, D. H. (2022). An intradialytic aerobic exercise program ameliorates frailty and improves dialysis adequacy and quality of life among hemodialysis patients: a randomized controlled trial. *Kidney Research and Clinical Practice, 41*(4), 462. https://doi.org/10.23876/j.krcp.21.284

Kirkman, D. L., Scott, M., Kidd, J., & Macdonald, J. H. (2019, July). The effects of intradialytic exercise on hemodialysis adequacy: a systematic review. In *Seminars in Dialysis* (Vol. 32, No. 4, pp. 368-378). https://doi.org/10.1111/sdi.12785

Krase, A. A., Terzis, G., Giannaki, C. D., Stasinaki, A. N., Wilkinson, T. J., Smith, A. C., ... & Sakkas, G. K. (2022). Seven months of aerobic intradialytic exercise training can prevent muscle loss in haemodialysis patients: an ultrasonography study. *International Urology and Nephrology*, 1-10. https://doi.org/10.1007/s11255-021-02931-6

Lagadec, N., Steinecker, M., Kapassi, A., Magnier, A. M., Chastang, J., Robert, S., ... & Ibanez, G. (2018). Factors influencing the quality of life of pregnant women: A systematic review. *BMC Pregnancy and Childbirth, 18*, 1-14. https://doi.org/10.1186/s12884-018-2087-4

Liao, B., Zhao, L., Peng, Y., Chen, J., Chen, W., & Wang, X. (2020). Effect of comprehensive nursing intervention on negative emotion, quality of life and renal function of hemodialysis patients. *International Journal of Clinical and Experimental Medicine,13*(2), 949-957. https://www.cochranelibrary.com/central/doi/10.1002/central/CN-02099406/full

Lin, C. H., Hsu, Y. J., Hsu, P. H., Lee, Y. L., Lin, C. H., Lee, M. S., & Chiang, S. L. (2021). Effects of intradialytic exercise on dialytic parameters, health-related quality of life, and depression status in hemodialysis patients: a randomized controlled trial. *International Journal of Environmental Research and Public Health, 18*(17), 9205. https://doi.org/10.3390/ijerph18179205

Ling, C., Evans, D., Zhang, Y., Luo, J., Hu, Y., Ouyang, Y., ... & Kuang, Z. (2020). The effects of cognitive behavioural therapy on depression and quality of life in patients with maintenance haemodialysis: a systematic review. *BMC Psychiatry, 20*, 1-14. https://doi.org/10.1186/s12888-020-02754-2

Liu, Y., Zhang, G. M. Y., Peng, X., Li, X., Sun, H., & Chen, L. (2022). Diffusion kurtosis imaging as an imaging biomarker for predicting prognosis in chronic kidney disease patients. *Nephrology Dialysis Transplantation, 37*(8), 1451-1460. https://doi.org/10.1093/ndt/gfab229

Liyanage, T., Toyama, T., Hockham, C., Ninomiya, T., Perkovic, V., Woodward, M., ... & Jun, M. (2022). Prevalence of chronic kidney disease in Asia: a systematic review and analysis. *BMJ Global Health, 7*(1), e007525.

https://doi.org/10.1136/bmjgh-2021-007525

López-Torres, O., Azpeitia-Martínez, C., González-Gross, M., Reihmane, D., & Guadalupe-Grau, A. (2021). Multicomponent home-based training program for chronic kidney disease patients during movement restriction. *International Journal of Environmental Research and Public Health, 18*(7), 3416. https://doi.org/10.3390/ijerph18073416

Lu, Y., Wang, Y., & Lu, Q. (2019). Effects of exercise on muscle fitness in dialysis patients: a systematic review and meta-analysis. *American Journal of Nephrology, 50*(4), 291-302. https://doi.org/10.1159/000502635

Maniam, R., Subramanian, P., Singh, S. K. S., Lim, S. K., Chinna, K., & Rosli, R. (2014). Preliminary study of an exercise programme for reducing fatigue and improving sleep among long-term haemodialysis patients. *Singapore Medical Journal, 55*(9), 476. https://doi.org/10.11622/smedj.2014119

Margolis, L. M., Wilson, M. A., Whitney, C. C., Carrigan, C. T., Murphy, N. E., Hatch-McChesney, A., & Pasiakos, S. M. (2021). Initiating aerobic exercise with low glycogen content reduces markers of myogenesis but not mTORC1 signaling. *Journal of The International Society of Sports Nutrition, 18*, 1-8. https://doi.org/10.1186/s12970-021-00455-z

Martins do Valle, F., Valle Pinheiro, B., Almeida Barros, A. A., Ferreira Mendonça, W., de Oliveira, A. C., de Oliveira Werneck, G., ... & Moura Reboredo, M. (2020). Effects of intradialytic resistance training on physical activity in daily life, muscle strength, physical capacity and quality of life in hemodialysis patients: a randomized clinical trial. *Disability and Rehabilitation, 42*(25), 3638-3644. https://doi.org/10.1080/09638288. 2019.1606857

Mathew, A., & Latsha, S. (2014). Effectiveness of intradialytic exercise on fatigue and quality of life among chronic renal failure patients undergoing hemodialysis in a selected hospital at Mangalore. *Journal of International Academic Research for Multidisciplinary, 2*(7), 418-424. https://www.jiarm.com/Aug2014/paper16812.pdf

Mayes, J., Koufaki, P., & Greenwood, S. A. (2023). Physical Activity, Function, and Exercise-Based Rehabilitation for People on Dialysis. In Handbook of Dialysis Therapy (pp. 582-589). *Elsevier*. https://doi.org/10.1016/B978-0-323-79135-9.00060-4

Mohamed, S. A., Kanona, A. A., & El-Gahsh, N. F. (2020). Effect of intradialytic range of motion exercises on dialysis efficacy and blood pressure among patients undergoing hemodialysis. *Menoufia Nursing Journal, 5*(2), 39-54. https://doi.org/10.21608/menj.2020.151588

Muliani, R., Muslim, A. R., & Abidin, I. (2021). Intradialytic exercise: flexibility terhadap skor fatigue pada pasien Penyakit Ginjal Kronis yang menjalani hemodialisis. *Journal of Medicine and Health, 3*(2). https://doi.org/10.28932/jmh.v3i2.3147

Negara, C. K., Basid, A., Erliani, S., & Turahman, I. (2019). The Relationship Between Discharge Planning and The Quality of Life of Patients with Diabetic Ulcer. *Indonesian Nursing Journal of Education and Clinic (INJEC), 4*(1), 20-24. https://doi.org/http://dx.doi.org/10.24990/injec.v4i1.218

Ng, C. Z., Tang, S. C., Chan, M., Tran, B. X., Ho, C. S., Tam, W. W., & Ho, R. C. (2019). A systematic review and meta-analysis of randomized controlled trials of cognitive behavioral therapy for hemodialysis patients with depression. *Journal of Psychosomatic Research, 126*, 109834. https://doi.org/10.1016/j.jpsychores. 2019.109834

Ortega-Pérez de Villar, L., Martínez-Olmos, F. J., Pérez-Domínguez, F. D. B., Benavent-Caballer, V., Montañez-Aguilera, F. J., Mercer, T., & Segura-Ortí, E. (2020). Comparison of intradialytic versus home-based exercise programs on physical functioning, physical activity level, adherence, and health-related quality of life: pilot study. *Scientific Reports, 10*(1), 8302. https://doi.org/10.1038/s41598-020-64372-y

Otte, C. (2011). Cognitive behavioral therapy in anxiety disorders: current state of the evidence. *Dialogues in Clinical Neuroscience, 13*(4), 413-421. https://doi.org/10.31887/DCNS.2011.13.4/cotte

Park, J. Y., Jung, J., Kim, Y. C., Lee, H., Kim, E., Kim, Y. S., ... & Lee, J. P. (2021). Effects of residential greenness on clinical outcomes of patients with chronic kidney disease: a large-scale observation study. *Kidney Research and Clinical Practice, 40*(2), 272. https://doi.org/10.23876/j.krcp.20.224

Pearce, C. J., Hall, N., Hudson, J. L., Farrington, K., Tucker, M. J. R., Wellsted, D., ... & Chilcot, J. (2024). Approaches to the identification and management of depression in people living with chronic kidney disease: A scoping review of 860 papers. *Journal of Renal Care, 50*(1), 4-14. https://doi.org/10.1111/jorc.12458

Penny, J. D., Salerno, F. R., Brar, R., Garcia, E., Rossum, K., McIntyre, C. W., & Bohm, C. J. (2019). Intradialytic exercise preconditioning: an exploratory study on the effect on myocardial stunning. *Nephrology Dialysis Transplantation, 34*(11), 1917-1923. https://doi.org/10.1093/ndt/gfy376

Pu, J., Jiang, Z., Wu, W., Li, L., Zhang, L., Li, Y., ... & Ou, S. (2019). Efficacy and safety of intradialytic exercise in haemodialysis patients: a systematic review and meta-analysis. *BMJ Open, 9*(1), e020633. https://doi.org/10.1136/bmjopen-2017-020633

Ravera, A., Santema, B. T., Sama, I. E., Meyer, S., Lombardi, C. M., Carubelli, V., ... & Voors, A. A. (2021). Quality of life in men and women with heart failure: association with outcome, and comparison between the Kansas City Cardiomyopathy Questionnaire and the EuroQol 5 dimensions questionnaire. *European Journal of Heart Failure, 23*(4), 567-577. https://doi.org/10.1002/ejhf.2154

Ravindran, A., Sunny, A., Kunnath, R. P., & Divakaran, B. (2020). Assessment of quality of life among end-stage renal disease patients undergoing maintenance hemodialysis. *Indian Journal of Palliative Care, 26*(1), 47. https://doi.org/10.4103/IJPC.IJPC_141_19

Rhee, S. Y., Song, J. K., Hong, S. C., Choi, J. W., Jeon, H. J., Shin, D. H., ... & Oh, J. (2019). Intradialytic exercise improves physical function and reduces intradialytic hypotension and depression in hemodialysis patients. *The Korean Journal of Internal Medicine, 34*(3), 588. https://doi.org/10.3904/kjim.2017.020

Rochmawati, E., Utomo, E. K., & Makiyah, S. N. N. (2022). Improving dialysis adequacy and quality of life in patients undergoing hemodialysis with twice a week range of motion exercise. *Therapeutic Apheresis and Dialysis, 26*(1), 140-146. https://doi.org/10.1111/1744-9987.13701

Şahin, D. S., Özer, Ö., & Yanardağ, M. Z. (2019). Perceived social support, quality of life and satisfaction with life in elderly people. *Educational Gerontology, 45*(1), 69-77. https://doi.org/10.1080/03601277.2019.1585065

Salhab, N., Karavetian, M., Kooman, J., Fiaccadori, E., & El Khoury, C. F. (2019). Effects of intradialytic aerobic exercise on hemodialysis patients: a systematic review and meta-analysis. *Journal of Nephrology, 32*, 549-566. https://doi.org/10.1007/s40620-018-00565-z

Shirazian, S., Smaldone, A., Rao, M. K., Silberzweig, J., Jacobson, A. M., Fazzari, M., & Weinger, K. (2018). A protocol for a pilot randomized controlled trial to assess the feasibility and effect of a cognitive behavioral intervention on quality of life for patients on hemodialysis. *Contemporary Clinical Trials, 73*, 51-60. https://doi.org/10.1016/j.cct.2018.08.012

Sohn, B. K., Oh, Y. K., Choi, J. S., Song, J., Lim, A., Lee, J. P., ... & Lim, C. S. (2018). Effectiveness of group cognitive behavioral therapy with mindfulness in end-stage renal disease hemodialysis patients. *Kidney Research and Clinical Practice, 37*(1), 77. https://doi.org/10.23876/j.krcp.2018.37.1.77

Solati, K., Mardani, S., Ahmadi, A., & Danaei, S. (2018). Effect of mindfulness-based cognitive therapy on quality of life and self-efficacy in dialysis patients. *Journal of Renal Injury Prevention, 8*(1), 28-33. https://doi.org/10.15171/jrip.2019.06

Suhardjono, Umami, V., Tedjasukmana, D., & Setiati, S. (2019). The effect of intradialytic exercise twice a week on the physical capacity, inflammation, and nutritional status of dialysis patients: a randomized controlled trial.

Hemodialysis International, 23(4), 486-493. https://doi.org/10.1111/hdi.12764

Thenmozhi, P. (2018). Quality of life of patients undergoing hemodialysis. *Asian Journal of Pharmaceutical and Clinical Research, 11*(4), 219-223. https://doi.org/10.22159/ajpcr.2018.v11i4.24007

Utami, I. T., Dewi, T. K., Nurhayati, S., & Annisa, F. (2022). Comparison the Efectiveness of Autogenic Relaxation and Deep Breath Relaxation on Fatigue Value in Renal Failure Patients During Hemodyalisis. *Jurnal Ilmiah Ilmu Keperawatan Indonesia, 12*(02), 53-58. https://doi.org/10.33221/jiiki.v12i02.1942

Valsaraj, B. P., Bhat, S. M., Prabhu, R., & Kamath, A. (2021). Follow-up study on the effect of cognitive behaviour therapy on haemodialysis adherence: a randomised controlled trial. *Sultan Qaboos University Medical Journal, 21*(1), e58. https://doi.org/10.18295/squmj.2021.21.01.008

Verrelli, D., Sharma, A., Alexiuk, J., Tays, Q., Rossum, K., Sharma, M., ... & Bohm, C. (2024). Effect of intradialytic exercise on cardiovascular outcomes in maintenance hemodialysis: a systematic review and meta-analysis. *Kidney360*, 10-34067. https://doi.org/10.34067/KID.0000000000000361

Warsame, F., Ying, H., Haugen, C. E., Thomas, A. G., Crews, D. C., Shafi, T., ... & McAdams-DeMarco, M. A. (2018). Intradialytic activities and health-related quality of life among hemodialysis patients. *American Journal of Nephrology, 48*(3), 181-189. https://doi.org/10.1159/000492623

Wayan, D. (2021). Benefits of Intradialytic Exercise to Increase Muscle Strength, Prevent Muscle Mass Loss on Chronic Renal Failure Patients on Hemodialysis. *Jurnal Keperawatan Cikini, 2*(1). https://doi.org/10.55644/jkc.v2i1.44

Wilund, K. R., Jeong, J. H., & Greenwood, S. A. (2019, July). Addressing myths about exercise in hemodialysis patients. In *Seminars in Dialysis* (Vol. 32, No. 4, pp. 297-302). https://doi.org/10.1111/sdi.12815

Yang, X. X., Hao, L. Y., Chen, Y. Y., & Meng, F. J. (2021). Effects of progressive muscle relaxation therapy on Maintenance Hemodialysis patients: a systematic review and meta-analysis. *TMR Integrative Medicine, 5*, e21003. https://doi.org/10.53388/tmrim202105003

Yoon, H., Chatters, L., Kao, T. S. A., Saint-Arnault, D., & Northouse, L. (2018). Predictors of quality of life and depression among Korean-American cancer patients and their family caregivers. *Psycho-Oncology, 27*(12), 2717-2724. https://doi.org/10.1002/pon.4864

Zegarow, P., Manczak, M., Rysz, J., & Olszewski, R. (2020). The influence of cognitive-behavioral therapy on depression in dialysis patients–meta-analysis. *Archives of Medical Science, 15*(1). https://doi.org/10.5114/aoms.2019.88019

Zhianfar, L., Nadrian, H., Asghari Jafarabadi, M., Espahbodi, F., & Shaghaghi, A. (2020). Effectiveness of a multifaceted educational intervention to enhance therapeutic regimen adherence and quality of life amongst iranian hemodialysis patients: A randomized controlled trial (MEITRA study). *Journal of Multidisciplinary Healthcare*, 361-372. https://doi.org/10.2147/JMDH.S247128