



International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

2734 17 Avenue SW,
Calgary, Alberta, T3E0A7,
Canada
+15878858911
editorial-office@sciformat.ca

ARTICLE TITLE	THE ROLE OF PHYSICAL ACTIVITY IN IMPROVING HEALTH AND QUALITY OF LIFE IN DIALYSIS PATIENTS: LITERATURE REVIEW
----------------------	---

DOI	https://doi.org/10.31435/ijitss.4(52).2026.6527
------------	---

RECEIVED	12 August 2026
-----------------	----------------

ACCEPTED	08 October 2026
-----------------	-----------------

PUBLISHED	15 October 2026
------------------	-----------------

LICENSE



The article is licensed under a **Creative Commons Attribution 4.0 International License**.

© The author(s) 2026.

This article is published as open access under the Creative Commons Attribution 4.0 International License (CC BY 4.0), allowing the author to retain copyright. The CC BY 4.0 License permits the content to be copied, adapted, displayed, distributed, republished, or reused for any purpose, including adaptation and commercial use, as long as proper attribution is provided.

THE ROLE OF PHYSICAL ACTIVITY IN IMPROVING HEALTH AND QUALITY OF LIFE IN DIALYSIS PATIENTS: LITERATURE REVIEW

Julia Wójcik (Corresponding Author, Email: julia.w8jci7@gmail.com)

Faculty of Medicine, Medical University of Warsaw, Żwirki i Wigury 61,02-091 Warsaw, Poland

ORCID ID: 0009-0007-6910-304X

Zuzanna Głowacka

Faculty of Medicine, Medical University of Warsaw, Żwirki i Wigury 61,02-091 Warsaw, Poland

ORCID ID: 0009-0002-2072-1844

ABSTRACT

Background and Objective: Physical activity is an important determinant of health and functional capacity, yet patients with end-stage kidney disease undergoing dialysis are characterized by markedly reduced physical activity levels. This review aimed to summarize current evidence on the effects of physical activity on health outcomes in dialysis patients and to identify major barriers to its implementation in routine care.

Methods: A literature review was conducted using the PubMed database. Studies addressing physical activity and exercise in patients undergoing dialysis were identified using the keywords “physical activity” and “dialysis”. The reviewed literature focused on physical functioning, cardiovascular health, muscle preservation, nutritional status, psychological well-being, sleep quality, hospitalization, mortality, and barriers to exercise participation.

Results: Available evidence indicates that regular physical activity may improve functional capacity, muscle strength, cardiovascular fitness, nutritional and psychological status, sleep quality, and quality of life in dialysis patients. Exercise interventions appear to be generally feasible and safe when appropriately individualized and monitored. However, physical activity remains insufficiently integrated into routine dialysis care. Important barriers include fatigue, comorbidities, low motivation, limited patient education, insufficient healthcare provider training, lack of resources, and the absence of standardized exercise recommendations.

Conclusions: Physical activity should be considered an integral component of comprehensive dialysis care. Individualized exercise programs supported by multidisciplinary healthcare teams may improve patient outcomes and quality of life. Further research is needed to establish standardized exercise recommendations for this population.

KEYWORDS

Physical Activity, Dialysis, End-Stage Kidney Disease, Exercise, Quality of Life, Nutritional Status

CITATION

Wójcik, J., & Głowacka, Z. (2026). The role of physical activity in improving health and quality of life in dialysis patients: Literature review. *International Journal of Innovative Technologies in Social Science*, 4(52). [https://doi.org/10.31435/ijitss.4\(52\).2026.6527](https://doi.org/10.31435/ijitss.4(52).2026.6527)

COPYRIGHT

© The author(s) 2026. This article is published as open access under the **Creative Commons Attribution 4.0 International License (CC BY 4.0)**, allowing the author to retain copyright. The CC BY 4.0 License permits the content to be copied, adapted, displayed, distributed, republished, or reused for any purpose, including adaptation and commercial use, as long as proper attribution is provided.

1. Introduction

Physical activity is considered an essential component of maintaining overall health, preserving functional capacity, and reducing the risk of developing or worsening chronic diseases. Regular engagement in physical exercise contributes to improvements in cardiovascular function, muscle strength, mobility, and psychological well-being. However, despite the recognized benefits of an active lifestyle, patients with end-stage kidney disease (ESKD) undergoing dialysis treatment remain a population characterized by substantially reduced levels of physical activity compared with healthy individuals. This physical inactivity represents an important clinical concern, as it is associated with deterioration of physical performance, increased functional limitations, reduced quality of life, and adverse effects on both physical and mental health outcomes in this group of patients (Amann & Halle, 2006).

Individuals receiving dialysis therapy represent a particularly vulnerable patient population due to the complex clinical course of ESKD and the frequent coexistence of multiple chronic conditions. The burden of comorbidities, including cardiovascular disease, diabetes mellitus, and progressive loss of skeletal muscle mass and strength, significantly contributes to reduced exercise capacity and impaired physical functioning. Moreover, the demanding nature of dialysis treatment, which requires regular and time-consuming sessions, may considerably restrict patients' daily routines, limit opportunities for participation in physical activity, and negatively influence social engagement. Prolonged treatment schedules, combined with disease-related symptoms such as fatigue and decreased physical endurance, often contribute to a sedentary lifestyle and increased risk of social isolation. Consequently, dialysis patients experience a substantially higher risk of hospitalization and mortality compared with the general population, highlighting the importance of interventions aimed at improving physical activity levels and preserving functional independence in this group (Bennett et al., 2019).

2. Methodology

This study was conducted as a narrative literature review examining the available evidence on the role of physical activity and exercise in patients undergoing dialysis therapy. A literature search was performed using the PubMed database, which was selected as the primary source of biomedical and clinical literature relevant to nephrology, dialysis, rehabilitation, and physical activity.

The search strategy was based on the combination of the keywords "physical activity" and "dialysis". Publications identified through this search were considered for inclusion if they addressed physical activity, exercise, or exercise-related outcomes in patients receiving dialysis therapy. The literature search covered publications published between 2004 and 2025, allowing the review to incorporate both established evidence and more recent findings concerning physical activity in the dialysis population.

Studies were considered eligible when they investigated patients undergoing dialysis and examined the relationship between physical activity or structured exercise and clinically relevant health outcomes. Both clinical and observational studies were included. Clinical studies comprised investigations evaluating the effects, feasibility, or safety of exercise interventions, whereas observational studies were considered when they examined associations between physical activity levels and health-related outcomes in dialysis patients.

The reviewed studies were selected according to their relevance to the main objectives of the review. Particular attention was given to studies addressing physical functioning, cardiovascular health, skeletal muscle strength and preservation, nutritional status, psychological well-being, sleep quality, quality of life, hospitalization, and mortality. Studies examining barriers to physical activity participation and factors affecting the implementation of exercise in routine dialysis care were also considered.

The selected publications were analyzed qualitatively. Relevant information was extracted from the included studies with particular emphasis on study characteristics, patient populations, type of dialysis therapy, characteristics of physical activity or exercise interventions, and reported clinical outcomes. Where applicable, the type, intensity, duration, and frequency of exercise were considered when interpreting the findings.

The evidence was subsequently organized thematically according to the principal health outcomes associated with physical activity. The analysis focused on identifying consistent findings across studies, potential differences between study populations and exercise approaches, and factors that may influence the effectiveness and feasibility of physical activity interventions. Particular attention was also given to reported barriers to exercise participation, including patient-related, clinical, and healthcare system-related factors.

Due to the heterogeneity of the identified studies with respect to study design, exercise protocols, outcome measures, and patient characteristics, the findings were synthesized descriptively rather than through quantitative meta-analysis. The results of the reviewed literature were used to provide an integrated overview of the potential benefits, limitations, safety, and practical implementation of physical activity among patients undergoing dialysis.

The literature search was conducted in August 2025.

3. Results

The Health Effects of Physical Activity in Dialysis Patients Methodology

Physical activity provides a wide range of clinically significant health benefits for patients undergoing dialysis therapy. Regular engagement in appropriately adapted physical exercise has been shown to positively influence multiple aspects of health, including cardiovascular function, metabolic control, musculoskeletal condition, and psychological well-being. Given the high prevalence of physical impairment and comorbidities among dialysis patients, increasing physical activity levels represents an important component of comprehensive care aimed at improving functional capacity and overall health outcomes.

Regular physical activity contributes to favorable cardiovascular and metabolic adaptations in individuals receiving dialysis. It has been demonstrated to reduce blood pressure, improve peripheral insulin sensitivity, decrease vascular stiffness, and positively affect lipid metabolism. Furthermore, exercise promotes improvements in cardiorespiratory fitness, enhances aerobic capacity, and increases muscular strength, which are frequently impaired in patients with end-stage kidney disease. An additional important benefit of physical activity is its protective effect against the development and progression of muscle wasting. Muscle atrophy is a common and clinically relevant complication among dialysis patients, resulting from the combined effects of protein-energy wasting, chronic inflammation, metabolic disturbances, and reduced physical activity levels. Therefore, regular exercise may play a crucial role in preserving muscle mass and maintaining physical independence in this population (Anand et al., 2011).

In addition to its effects on physical performance, physical activity is also associated with improved nutritional status among patients undergoing dialysis. More physically active individuals tend to demonstrate greater preservation of lean body mass and more favorable nutritional parameters, including higher serum albumin and prealbumin concentrations, which are important indicators of nutritional condition and prognosis in dialysis patients (Thangarasa et al., 2018).

Beyond the physiological benefits, physical activity has a significant positive impact on psychological health and quality of life among patients undergoing dialysis therapy. The psychological burden associated with end-stage kidney disease and long-term dialysis treatment is substantial, as patients frequently experience emotional distress, uncertainty regarding their prognosis, limitations in daily functioning, and reduced participation in social and professional activities. These challenges may negatively influence patients' perception of health, emotional well-being, and ability to adapt to living with a chronic disease. Therefore, interventions aimed at improving psychological outcomes represent an important component of comprehensive dialysis care.

Regular exercise participation may contribute to a reduction in symptoms of depression, anxiety, and fatigue, which are frequently reported among individuals undergoing long-term dialysis treatment. Depression and anxiety are common psychological complications in dialysis patients and are associated with poorer quality of life, reduced treatment adherence, lower levels of self-care behaviors, and increased healthcare utilization. The development of depressive symptoms in this population is influenced by multiple factors, including the chronic nature of kidney disease, dependence on regular dialysis sessions, physical limitations, persistent symptoms such as fatigue and pain, and concerns regarding future health outcomes.

Physical activity may positively influence psychological well-being through several mechanisms. Regular exercise can promote the release of neurotransmitters and physiological adaptations associated with improved mood regulation, reduced stress perception, and enhanced emotional resilience. Additionally, participation in physical activity may increase patients' sense of autonomy and self-efficacy by allowing them to actively participate in managing their health condition. For individuals who often experience a loss of control related to chronic disease and dependence on medical treatment, the ability to engage in purposeful physical activity may provide psychological benefits beyond improvements in physical performance.

Furthermore, exercise participation may reduce fatigue, which is one of the most commonly reported and disabling symptoms among dialysis patients. Fatigue significantly affects daily functioning and may limit patients' ability to participate in social activities, maintain independence, and engage in rehabilitation. Although fatigue may initially represent a barrier to exercise, appropriately adapted physical activity programs have demonstrated potential to improve energy levels, physical endurance, and overall functional capacity. Through gradual improvement in physical fitness, patients may become more capable of performing daily activities, which can further enhance confidence and motivation to remain active.

The impact of physical activity extends beyond individual psychological outcomes and may contribute to overall improvements in health-related quality of life. Quality of life in dialysis patients is influenced not

only by survival outcomes but also by functional ability, independence, emotional status, social relationships, and the ability to participate in meaningful activities. By improving mobility, reducing symptoms of psychological distress, and promoting social engagement, physical activity may positively influence multiple dimensions of quality of life.

Moreover, higher levels of physical activity have been associated with improved clinical outcomes, including reduced rates of hospitalization and lower mortality risk in this vulnerable patient population. The relationship between increased physical activity and improved clinical outcomes may be explained by several interconnected mechanisms, including better cardiovascular function, improved muscle strength, enhanced nutritional status, reduced frailty, and improved ability to tolerate the physiological stress associated with chronic disease and medical interventions.

Patients who maintain higher levels of physical activity may have greater functional reserve and improved ability to recover from acute illnesses or hospitalization. In contrast, physically inactive individuals are more likely to experience progressive functional decline, complications related to frailty, and increased dependence on healthcare services. Therefore, promoting physical activity may represent an important strategy not only for improving quality of life but also for potentially reducing the overall burden of disease and healthcare utilization in dialysis populations.

Importantly, physical activity interventions should be individualized according to patients' functional capacity, comorbidities, treatment schedule, and personal preferences. Dialysis patients represent a heterogeneous population, and exercise recommendations should consider differences in age, baseline physical condition, cardiovascular risk, nutritional status, and previous experience with physical activity. Structured programs combining aerobic exercise, resistance training, and functional exercises may provide the greatest benefits when appropriately adapted and supervised.

These findings emphasize the importance of incorporating structured and individualized physical activity interventions into the multidisciplinary management of patients receiving dialysis. Effective implementation requires collaboration between nephrologists, nurses, physiotherapists, dietitians, and other healthcare professionals involved in dialysis care. Such an integrated approach may help overcome barriers to exercise participation, provide appropriate patient education, improve adherence, and ensure that physical activity becomes a routine and sustainable component of comprehensive treatment strategies.

Overall, physical activity should be considered not only as a method of improving physical performance but also as an important therapeutic tool supporting psychological health, social functioning, and long-term outcomes in patients undergoing dialysis therapy. The combination of physical and mental health benefits highlights the need for greater integration of exercise-based interventions into standard dialysis care models (Kang et al., 2017).

Consequences of Low Physical Activity in Dialysis Patients

Low levels of physical activity are highly prevalent among patients undergoing dialysis and represent a significant clinical concern due to their strong association with unfavorable health outcomes, progressive functional decline, reduced physical independence, and increased mortality risk. Compared with individuals who maintain higher levels of physical activity, dialysis patients characterized by reduced activity levels demonstrate substantially worse clinical outcomes and a higher probability of experiencing adverse events during the course of their disease. Physical inactivity in this population should not be considered merely as a consequence of chronic illness, but rather as an important clinical factor that may contribute to further deterioration of health status and accelerate disease-related complications.

Patients undergoing dialysis often experience a progressive reduction in physical activity as a result of multiple interacting factors, including the physiological consequences of end-stage kidney disease, chronic inflammation, anemia, cardiovascular impairment, muscle weakness, fatigue, and the psychological burden associated with long-term treatment. The combination of these factors frequently leads to decreased exercise tolerance and reduced participation in everyday physical activities. As a consequence, many patients enter a cycle of inactivity in which reduced movement contributes to further loss of physical capacity, while worsening physical condition creates additional barriers to maintaining an active lifestyle.

Previous studies have indicated that patients with low levels of physical activity have approximately a 3.5-fold higher risk of mortality compared with individuals presenting average levels of activity, emphasizing the strong relationship between physical inactivity and survival outcomes in this population (Johansen et al., 2013). This substantial difference in mortality risk highlights the clinical importance of physical activity as a potentially modifiable factor influencing long-term prognosis among dialysis patients. Although physical

inactivity is often associated with advanced age, disease severity, and the presence of multiple comorbidities, evidence suggests that improving even relatively low levels of activity may provide meaningful health benefits and may contribute to reducing the negative consequences associated with a sedentary lifestyle.

The association between reduced physical activity and increased mortality emphasizes the need to recognize exercise not only as a component of a healthy lifestyle but also as a potentially therapeutic intervention in dialysis care. Incorporating physical activity assessment into routine clinical practice may allow healthcare providers to identify patients at increased risk of functional decline and adverse outcomes. Early recognition of inactivity and implementation of individualized exercise strategies may represent an important opportunity to improve physical functioning, preserve independence, and potentially influence long-term survival.

The mechanisms underlying the association between physical inactivity and increased mortality in dialysis patients are complex and multifactorial. Reduced physical activity may contribute to the progression of cardiovascular disease, loss of skeletal muscle mass, impaired metabolic regulation, worsening nutritional status, and deterioration of functional capacity, all of which are common complications of end-stage kidney disease. Cardiovascular impairment is particularly relevant, as patients receiving dialysis already have a significantly elevated cardiovascular risk due to chronic inflammation, vascular calcification, hypertension, metabolic abnormalities, and accelerated atherosclerotic processes. A sedentary lifestyle may further aggravate these conditions by reducing cardiovascular fitness, impairing vascular function, and limiting the beneficial adaptations associated with regular exercise.

Furthermore, insufficient physical activity contributes to progressive loss of skeletal muscle mass and strength, which is one of the most clinically significant problems observed in dialysis patients. Muscle wasting results from the interaction between chronic inflammatory processes, altered protein metabolism, inadequate nutritional intake, and reduced mechanical stimulation of muscles caused by inactivity. The resulting decline in muscle function may negatively affect patients' ability to perform daily activities and increase dependence on caregivers. Over time, progressive muscle deterioration may contribute to a worsening cycle in which reduced strength leads to lower activity levels, and lower activity levels further accelerate muscle loss.

Furthermore, prolonged sedentary behavior may accelerate the development of frailty, a multidimensional syndrome characterized by decreased physiological reserve, increased vulnerability to stressors, and reduced ability to recover from illness or medical interventions. Frailty is particularly prevalent among individuals undergoing dialysis and represents a major clinical challenge due to its association with increased dependence, higher hospitalization rates, prolonged recovery after medical events, and poorer long-term outcomes. The development of frailty reflects not only physical deterioration but also the interaction between medical, psychological, nutritional, and social factors affecting patients with chronic kidney disease.

Physical inactivity among dialysis patients contributes to a progressive deterioration of physical function and may accelerate the development of frailty, which represents one of the major challenges in the management of individuals with end-stage kidney disease. Reduced levels of activity are associated with decreased muscle strength, impaired postural stability, reduced endurance, and deterioration of mobility. These changes significantly affect patients' ability to maintain independence and may limit participation in basic daily activities, including walking, shopping, preparing meals, and engaging in social interactions.

The decline in physical function associated with inactivity has important consequences for patient safety and quality of life. Reduced muscle strength and impaired balance increase the likelihood of falls, which represent a serious complication among dialysis patients. Falls may lead to injuries, fractures, hospitalization, prolonged immobilization, and additional loss of functional capacity. Furthermore, experiencing a fall may increase patients' fear of movement and contribute to further avoidance of physical activity, creating a self-perpetuating cycle of inactivity and progressive disability.

The relationship between physical inactivity, frailty, and functional decline demonstrates the importance of maintaining physical activity throughout the course of dialysis treatment. Even small increases in daily movement and appropriately adapted exercise may help preserve muscle function, improve balance, maintain mobility, and reduce the risk of complications associated with physical deterioration. Therefore, strategies aimed at preventing inactivity and promoting safe, individualized exercise should be considered an important component of comprehensive care for patients undergoing dialysis (Johansen et al., 2013).

Over time, the combination of muscle weakness, reduced exercise tolerance, and fear of falling may create a self-perpetuating cycle in which patients become increasingly inactive, resulting in further physical decline and reduced independence in performing daily activities.

Loss of mobility and functional impairment have important consequences for patients' overall health status and quality of life. Many dialysis patients experience difficulties with routine activities such as walking longer distances, performing household tasks, or maintaining social participation. As physical capacity declines, patients may become increasingly dependent on caregivers and healthcare services, which can negatively affect their autonomy, emotional well-being, and sense of control over their condition. Therefore, strategies aimed at preserving physical function and preventing inactivity-related decline represent an essential component of comprehensive dialysis care.

Furthermore, a sedentary lifestyle has been associated with a higher prevalence of sleep-related disorders among dialysis patients. Sleep disturbances, including insomnia, poor sleep quality, and restless legs syndrome, are frequently reported in this population and may significantly impair daily functioning and overall well-being. Patients with lower levels of physical activity are more likely to experience persistent sleep problems, which may contribute to increased daytime fatigue, reduced concentration, impaired mood regulation, and decreased motivation to engage in physical activity. This creates a negative feedback loop in which poor sleep quality further limits physical activity participation, while inactivity contributes to worsening sleep patterns (Anand et al., 2013)

The relationship between physical inactivity and psychological burden is also particularly important in dialysis patients. Individuals who engage in limited physical activity frequently report higher levels of depressive symptoms, anxiety, emotional distress, and reduced overall quality of life. These psychological consequences are closely related to the physical limitations associated with chronic kidney disease, the demanding nature of dialysis treatment, and the social restrictions caused by long-term illness. Reduced participation in physical activity may additionally contribute to social isolation by limiting opportunities for interaction and engagement in everyday activities (Johansen et al., 2010)

In addition to its impact on physical and psychological outcomes, insufficient physical activity has been identified as an important predictor of mortality and other adverse clinical outcomes in the dialysis population. The accumulation of negative consequences associated with inactivity, including worsening cardiovascular health, sarcopenia, frailty, impaired nutritional status, and reduced functional independence, may substantially contribute to increased morbidity and mortality risk. These findings underline the importance of identifying physical inactivity as a clinically relevant risk factor that should be addressed as part of routine dialysis management.

Importantly, current research indicates that meaningful health benefits can be achieved even with relatively low- to moderate-intensity physical activity. Patients undergoing dialysis do not necessarily require high-intensity exercise programs to experience improvements in health outcomes. Activities adapted to individual abilities, functional limitations, and medical conditions, such as walking, low-intensity aerobic exercise, resistance training, or supervised rehabilitation programs, may provide significant benefits. This is particularly relevant given that many dialysis patients present with reduced exercise tolerance and multiple comorbidities that may limit participation in more demanding forms of exercise.

Therefore, maintaining an active lifestyle adapted to each patient's clinical condition, physical capacity, and personal limitations should be considered an essential component of supportive care for individuals receiving dialysis therapy.

Promoting even small increases in daily activity levels may contribute to preserving mobility, preventing functional decline, improving psychological well-being, and potentially reducing the risk of adverse clinical outcomes. Integrating individualized physical activity recommendations into routine dialysis care, supported by appropriate education and multidisciplinary healthcare involvement, represents an important step toward improving long-term health outcomes and quality of life in this vulnerable patient population (Stack et al., 2005).

Barriers to Physical Activity

The barriers limiting physical activity among patients undergoing dialysis are complex and multifactorial, involving both individual patient-related factors and healthcare system-related limitations. Understanding these obstacles is essential for developing effective strategies aimed at increasing exercise participation and improving long-term outcomes in this population (Jagannathan et al., 2018).

From the patient's perspective, several factors contribute to reduced engagement in physical activity. The most commonly reported barriers include persistent fatigue, fear of injury, lack of motivation, and the presence of multiple comorbid conditions that may limit physical capacity and confidence in performing exercise (Janeiro et al., 2015). Many dialysis patients also experience uncertainty regarding the appropriate

type, intensity, and frequency of physical activity, which may result from the absence of clear and individualized exercise recommendations. The lack of well-defined guidelines regarding safe and effective exercise programs represents an additional obstacle, as patients may be hesitant to initiate physical activity without professional guidance and reassurance (Isnard-Rouchon et al., 2019).

Psychological factors also play an important role in limiting physical activity among individuals receiving dialysis. Symptoms of depression, anxiety, reduced self-efficacy, and concerns related to disease progression may negatively influence patients' willingness to participate in exercise and decrease their overall motivation to adopt an active lifestyle (Stack & Murthy, 2008). In contrast, encouragement, education, and continuous support provided by dialysis healthcare professionals have been identified as some of the strongest factors promoting physical activity participation. Motivation and positive reinforcement from members of the dialysis team can significantly influence patients' attitudes toward exercise and increase their willingness to engage in regular physical activity (Kim et al., 2021). The least physically active subgroup consists predominantly of older individuals with multiple chronic diseases, who often face additional limitations related to frailty, reduced functional capacity, and increased disease burden (Fiaccadori et al., 2014).

From the healthcare system perspective, several organizational and professional barriers may also restrict the implementation of physical activity interventions in dialysis settings. Frequently reported challenges include limited time available for healthcare providers to educate patients about the benefits, safety, and practical aspects of exercise, insufficient patient expectations regarding the role of physical activity in disease management, and inadequate knowledge or confidence among healthcare professionals in prescribing and supporting exercise programs (Cupisti et al., 2013). Additionally, the limited availability of large-scale clinical trials evaluating the effectiveness, safety, and optimal structure of exercise interventions in dialysis patients remains an important limitation (da Costa Rosa et al., 2017). The lack of robust evidence from large randomized studies may contribute to uncertainty regarding standardized recommendations and hinder the widespread incorporation of physical activity into routine dialysis care (Bennett & Hussein, 2021).

Relationship Between Nutrition and Physical Activity

Physical activity is strongly associated with nutritional status and body composition, with both factors influencing each other in a dynamic and interdependent relationship. In patients undergoing dialysis, maintaining an adequate nutritional state and preserving muscle mass are particularly important due to the high prevalence of protein-energy wasting, inflammation, and progressive loss of functional capacity. Current evidence consistently indicates that individuals with higher levels of physical activity generally demonstrate more favorable nutritional parameters and healthier body composition characteristics compared with less active patients (Cupisti et al., 2011).

Patients characterized by greater lean body mass, adequate protein consumption, and higher concentrations of nutritional biomarkers, including serum albumin and prealbumin, are more likely to maintain higher levels of physical activity and better physical performance (Cobo et al., 2015). In contrast, reduced physical activity is strongly associated with markers of poor nutritional status, including decreased albumin and prealbumin levels, loss of muscle mass, and impaired functional capacity. These findings suggest that nutritional deficiencies and physical inactivity may contribute to a progressive decline in health status among dialysis patients, creating a cycle of worsening malnutrition, reduced exercise tolerance, and further deterioration of physical function (Anand et al., 2011).

Assessment of body composition using methods such as bioelectrical impedance analysis and dual-energy X-ray absorptiometry (DEXA) has provided additional evidence supporting the relationship between physical activity and body composition. Patients with higher amounts of fat-free mass and lower proportions of adipose tissue tend to achieve greater daily step counts and demonstrate better results in functional performance assessments. (Cupisti et al., 2011)

Moreover, phase angle, a parameter obtained from bioelectrical impedance analysis that reflects cellular integrity, hydration status, and overall cellular health, has been positively associated with physical function and exercise capacity in dialysis patients (Jhamb et al., 2023).

In addition, adequate dietary protein and energy intake appears to be an important predictor of higher levels of daily physical activity. Sufficient nutritional intake may provide the necessary resources for maintaining muscle strength, improving exercise tolerance, and supporting participation in regular physical activity. Conversely, increased physical activity may positively influence appetite, nutrient utilization, metabolic efficiency, and the preservation of functional independence.

Overall, available evidence suggests the existence of a beneficial and self-reinforcing cycle in which optimal nutritional status supports greater engagement in physical activity, while regular exercise contributes to improved nutritional condition, muscle preservation, and better overall health outcomes. Therefore, integrated interventions combining individualized nutritional support with structured physical activity programs are essential for improving clinical outcomes, particularly among dialysis patients at increased risk of malnutrition, sarcopenia, and progressive physical decline (Anand et al., 2011).

Impact of Physical Activity on Mental Health and Sleep

Patients undergoing dialysis frequently experience a broad spectrum of psychological and sleep-related disturbances, including depressive symptoms, anxiety disorders, insomnia, and restless legs syndrome. These complications represent common and clinically significant problems in the dialysis population, substantially affecting patients' daily functioning, emotional well-being, treatment adherence, and overall quality of life. The high prevalence of these conditions may be attributed to the complex interaction between the physiological consequences of end-stage kidney disease, the burden of long-term dialysis treatment, chronic inflammation, metabolic disturbances, fatigue, and the social limitations associated with living with a chronic illness. Importantly, psychological distress and sleep disorders in dialysis patients have also been associated with poorer clinical outcomes, including reduced quality of life and increased risk of adverse health events and mortality.

A growing body of observational research has demonstrated a consistent inverse relationship between physical activity levels and the severity of psychological and sleep-related symptoms among patients receiving dialysis therapy. Individuals who engage in lower levels of physical activity are more likely to experience persistent depressive symptoms, impaired sleep quality, increased fatigue, and greater psychological distress compared with more physically active patients. Reduced physical activity may contribute to a negative cycle in which physical deconditioning, social withdrawal, and decreased independence further worsen emotional health and sleep patterns. In contrast, maintaining regular physical activity may provide both physiological and psychological benefits by improving functional capacity, increasing self-confidence, promoting social interaction, and reducing the perception of disease-related limitations.

Sleep disturbances are particularly common among patients undergoing dialysis and represent an important factor negatively affecting quality of life. In one large cohort study, more than half of dialysis patients reported experiencing at least one chronic sleep-related problem, demonstrating the substantial burden of sleep disorders in this population (Anand et al., 2013). Insufficient sleep quality may further contribute to daytime fatigue, reduced motivation to participate in physical activity, impaired cognitive functioning, and decreased ability to perform everyday activities. Therefore, interventions aimed at improving sleep quality may have a significant impact on overall patient functioning and well-being.

The beneficial effects of physical activity on psychological health have also been demonstrated in interventional studies. One study involving patients undergoing continuous ambulatory peritoneal dialysis showed that regular walking performed two to four times per week, combined with motivational support, resulted in a significant reduction in depressive symptoms. These findings suggest that even relatively simple and accessible forms of physical activity may provide meaningful psychological benefits when appropriately adapted to patients' functional abilities and supported by healthcare professionals. However, this intervention did not demonstrate significant improvements in anxiety symptoms. Furthermore, these observations are consistent with findings from at least three additional studies, which similarly failed to demonstrate a consistent positive effect of physical activity on anxiety levels among dialysis patients. This suggests that while exercise may represent an effective supportive intervention for depression and sleep disturbances, its influence on anxiety symptoms may be more complex and may require additional psychological or behavioral interventions (Cupisti et al., 2017).

Overall, available evidence indicates that physical activity represents an important non-pharmacological strategy for improving mental health outcomes in individuals undergoing dialysis. The potential to reduce depressive symptoms, enhance sleep quality, and improve general psychological well-being highlights the importance of incorporating structured physical activity programs into comprehensive and patient-centered models of dialysis care. Furthermore, physical activity may provide additional psychosocial benefits by reducing social isolation, which is a frequent problem among individuals undergoing long-term dialysis treatment. Participation in supervised exercise programs, group-based activities, or rehabilitation sessions may create opportunities for social interaction, strengthen interpersonal relationships, and improve patients' sense of belonging and support (Cai et al., 2024).

Effectiveness and Implementation of Exercise Programs

Exercise interventions have demonstrated significant effectiveness in improving physical fitness, functional capacity, and overall well-being among patients receiving dialysis therapy. Numerous clinical studies have reported beneficial effects of structured exercise programs, including improvements in walking distance, lower extremity muscle strength, endurance, mobility, and health-related quality of life. These improvements are particularly relevant in dialysis patients, who frequently experience reduced exercise tolerance, muscle wasting, frailty, and progressive decline in physical independence due to the combined effects of kidney failure, chronic inflammation, metabolic abnormalities, and prolonged sedentary behavior.

Exercise programs implemented in dialysis populations typically incorporate a combination of aerobic and resistance training, with intensity and duration individually adjusted according to each patient's functional status, clinical condition, and exercise capacity. Aerobic activities, such as walking or cycling, primarily aim to improve cardiovascular fitness and endurance, whereas resistance exercises are focused on maintaining or increasing muscle strength and preventing the progression of sarcopenia. The combination of these approaches appears to provide the greatest benefits by addressing both cardiovascular limitations and musculoskeletal impairment commonly observed in patients with chronic kidney disease (Jhamb et al., 2023).

Importantly, the reviewed clinical trials consistently demonstrated a favorable safety profile of exercise interventions in dialysis patients. No serious adverse events related to physical activity were reported during the analyzed interventions, supporting the feasibility and safety of introducing structured exercise programs into routine dialysis care. These findings challenge the perception that dialysis patients are unable to safely participate in physical activity due to frailty, comorbidities, or disease severity. Instead, they emphasize the importance of appropriate patient selection, individualized exercise prescription, and professional supervision to maximize benefits while minimizing potential risks (Bennett & Hussein, 2021).

Despite substantial evidence supporting the effectiveness and safety of exercise interventions, structured physical activity programs remain insufficiently implemented in everyday dialysis practice. Only a limited number of dialysis centers have incorporated formal exercise interventions as part of standard patient management. Several factors contribute to this implementation gap, including insufficient healthcare professional training, limited institutional resources, lack of dedicated rehabilitation programs, inadequate time during dialysis sessions for exercise promotion, and concerns regarding the safety of physically vulnerable patients (Caselli et al., 2020).

Healthcare providers may also hesitate to recommend exercise due to uncertainty regarding appropriate intensity, contraindications, and methods of monitoring patients with complex medical conditions (Johansen et al., 2013).

Additionally, some patients may have low expectations regarding the potential benefits of physical activity or may perceive exercise as difficult or unrealistic due to fatigue, comorbidities, and long-term treatment burden (Greenwood, 2017). Addressing these barriers requires not only patient education but also improved awareness among healthcare professionals regarding the role of exercise as an essential component of supportive dialysis care (Majchrzak et al., 2005).

Considering the extensive body of evidence demonstrating clinically meaningful improvements in functional capacity, physical performance, psychological well-being, and overall quality of life, there is a strong and increasingly recognized need for the broader and more systematic implementation of supervised exercise programs within dialysis settings. The consistent findings reported across the available literature indicate that structured and appropriately supervised physical activity may represent an important component of comprehensive care for patients undergoing dialysis, particularly when such interventions are adapted to the individual functional abilities, clinical condition, and specific needs of each patient. Despite the growing amount of scientific evidence supporting the potential benefits of exercise-based interventions, their routine incorporation into everyday dialysis practice remains limited in many clinical settings. Therefore, overcoming logistical, organizational, and systemic barriers is essential for facilitating the practical implementation of exercise programs and for translating the findings obtained in research studies into sustainable clinical practice. Particular attention should be given to the organization of dialysis-unit-based exercise interventions, the availability of appropriately trained personnel, the allocation of adequate time and space, and the development of clear and feasible procedures that would allow exercise to become an integrated rather than an occasional element of patient care. Addressing these challenges may contribute to improving the accessibility, continuity, and consistency of supervised exercise interventions and may also facilitate their incorporation into existing models of multidisciplinary dialysis care. Furthermore, establishing appropriate organizational frameworks and supporting healthcare professionals in the implementation of such programs could help reduce existing disparities in access to exercise-based interventions among dialysis patients. Ensuring that patients receiving dialysis have regular access to safe, structured, individualized, and appropriately supervised physical activity is therefore an important consideration in the ongoing development of patient-centered approaches to dialysis care. Ultimately, broader implementation of supervised exercise programs may provide an opportunity to translate the substantial body of scientific evidence into routine clinical practice and to ensure that the

demonstrated benefits of physical activity are more consistently available to patients undergoing long-term dialysis treatment. (Bennett & Hussein, 2021).

A persistent limitation identified in the literature is the lack of universally accepted and standardized recommendations regarding exercise prescription for patients undergoing dialysis. Although available studies consistently demonstrate beneficial effects associated with regular physical activity, substantial differences in the type of exercise performed, training intensity, session duration, frequency of exercise, timing in relation to dialysis treatment, degree of supervision, and methods used to assess physical and functional outcomes make direct comparisons between studies challenging. These methodological differences may also contribute to variability in the interpretation of available evidence and make it more difficult to determine which exercise strategies are most appropriate for specific groups of dialysis patients. Furthermore, differences in patient characteristics, clinical status, comorbidities, dialysis modalities, and baseline levels of physical functioning may further influence the observed effects of exercise interventions and limit the generalizability of findings across different populations. The absence of clear consensus guidelines may therefore contribute to uncertainty among healthcare professionals regarding the appropriate prescription, progression, monitoring, and adaptation of exercise programs in routine clinical practice. This uncertainty may be particularly relevant when determining appropriate exercise intensity and duration or when adapting interventions to patients with different levels of functional capacity and clinical complexity. As a consequence, the lack of standardized recommendations may limit the routine integration of exercise into dialysis care pathways and contribute to differences in the availability and implementation of exercise-based interventions across clinical settings. Establishing evidence-based and clinically applicable recommendations could therefore help reduce methodological variability, facilitate the interpretation and comparison of future research findings, and provide healthcare professionals with a clearer framework for the safe and effective prescription of physical activity in patients undergoing dialysis (Bennett et al., 2020).

Therefore, there is a critical need for interdisciplinary collaboration involving nephrologists, physiotherapists, nurses, dietitians, rehabilitation specialists, and other healthcare professionals to establish comprehensive, evidence-based clinical guidelines for physical activity in dialysis patients. Such collaboration would enable the integration of knowledge and expertise from different areas of healthcare and facilitate the development of recommendations that adequately address the diverse clinical, functional, nutritional, and psychosocial needs of individuals undergoing dialysis treatment. A multidisciplinary approach could also contribute to the development of practical and clinically applicable guidance regarding the assessment of physical capacity, selection and adaptation of appropriate exercise modalities, determination of exercise intensity and duration, monitoring of patients during physical activity, and identification of potential contraindications or safety considerations. In addition, cooperation between different healthcare professionals could facilitate the individualization of exercise interventions according to patients' functional status, comorbidities, treatment characteristics, and changing clinical condition. The establishment of clear and standardized recommendations could further support healthcare professionals in incorporating physical activity into routine dialysis care and promote greater consistency in the delivery of exercise-based interventions across different clinical settings. Such guidelines may also provide an important framework for improving communication and coordination between members of the multidisciplinary team, thereby facilitating the systematic implementation of exercise programs and supporting their long-term sustainability. Ultimately, strengthening interdisciplinary collaboration and developing evidence-based clinical guidelines may represent an important step toward integrating physical activity more effectively into comprehensive dialysis management and ensuring that patients have access to safe, individualized, and appropriately supervised exercise interventions. (Lambert et al., 2022).

Development of standardized and evidence-based recommendations would facilitate the safe, consistent, and effective implementation of exercise programs across different dialysis settings, while also providing healthcare professionals with clear guidance regarding the appropriate structure, intensity, frequency, and supervision of physical activity interventions. Such recommendations could contribute to greater consistency in the delivery of exercise-based care, improve accessibility for patients undergoing dialysis, and help reduce variations in the availability and organization of exercise programs between individual dialysis centers. In addition, the establishment of standardized recommendations could support healthcare professionals in incorporating physical activity into routine clinical practice and facilitate its integration within existing multidisciplinary models of dialysis care. By providing a clear framework for the implementation and supervision of exercise interventions, standardized guidance may also help promote patient safety, encourage greater participation, and support the long-term continuity of physical activity. Ultimately, the development and implementation of such recommendations would support the integration of regular physical activity as a routine and sustainable component of comprehensive dialysis management, rather than treating exercise as an additional or optional intervention within the overall care of patients receiving dialysis (Kolko Labadens et al., 2014).

4. Discussion

The findings of this literature review indicate that physical activity may play an important role in improving multiple health outcomes among patients undergoing dialysis. The reviewed evidence suggests that the potential benefits of physical activity extend beyond improvements in physical performance and include cardiovascular health, preservation of muscle mass, nutritional status, psychological well-being, sleep quality, and health-related quality of life. At the same time, the consistently low levels of physical activity observed in dialysis populations and the association between physical inactivity and adverse clinical outcomes highlight an important gap between the potential benefits of exercise and its implementation in routine dialysis care.

One of the most important findings of the reviewed literature is the close relationship between physical activity and functional capacity. Patients undergoing dialysis are exposed to multiple factors that may contribute to progressive physical deterioration, including chronic inflammation, muscle wasting, comorbid cardiovascular disease, fatigue, and sedentary behavior. Reduced activity may consequently initiate a self-perpetuating cycle in which declining muscle strength and exercise tolerance lead to further reductions in physical activity, eventually contributing to frailty and loss of functional independence. The association between physical activity and survival reported in the Comprehensive Dialysis Study further emphasizes that physical activity may represent an important prognostic factor in this population (Johansen et al., 2013). However, the observational nature of some of the available evidence means that the relationship between physical activity and survival should not necessarily be interpreted as a direct causal effect. Patients who are more physically active may also have better baseline health, fewer comorbidities, or greater functional reserve. Nevertheless, the consistency of associations between physical activity, functional capacity, and clinical outcomes supports the relevance of exercise as an important component of dialysis care.

The relationship between physical activity and nutritional status is another important aspect of the reviewed evidence. Dialysis patients are particularly vulnerable to protein-energy wasting, loss of lean body mass, and progressive muscle deterioration. Studies included in this review indicate that higher physical activity is associated with more favorable nutritional parameters and better body composition (Anand et al., 2011; Cupisti et al., 2011). This relationship is likely bidirectional. Adequate energy and protein intake may support muscle function and exercise tolerance, while physical activity may contribute to the preservation of lean body mass and functional capacity. Therefore, exercise should not be considered independently of nutritional management. In patients at high risk of malnutrition or sarcopenia, combining individualized nutritional support with appropriately prescribed physical activity may be particularly important. This integrated approach may be more beneficial than interventions addressing either nutritional status or physical activity in isolation.

The psychological and social implications of physical activity are also clinically relevant. Dialysis treatment is associated with a substantial burden of fatigue, depressive symptoms, sleep disturbances, reduced independence, and social limitations. The reviewed studies suggest that higher physical activity is associated with better psychological well-being and sleep-related outcomes, while exercise interventions may contribute to reductions in depressive symptoms and improvements in quality of life. However, the available evidence does not appear to demonstrate equally consistent effects across all psychological outcomes. For example, the intervention discussed in the reviewed literature improved depressive symptoms but did not significantly improve anxiety, and similar findings have been reported in other studies (Cupisti et al., 2017). This suggests that physical activity should be viewed as one component of a broader multidisciplinary approach to psychological care rather than as a substitute for psychological or pharmacological interventions when these are clinically indicated. Exercise may nevertheless provide additional benefits by improving self-efficacy, physical independence, and opportunities for social interaction.

An important issue emerging from this review is the discrepancy between the evidence supporting physical activity and its limited implementation in dialysis settings. The barriers identified in the literature occur at both the patient and healthcare-system levels. Fatigue, comorbidities, fear of injury, lack of motivation, and uncertainty about appropriate exercise are important patient-related barriers. At the same time, insufficient professional training, limited resources, lack of dedicated rehabilitation programs, inadequate time, and the absence of standardized recommendations may prevent healthcare professionals from routinely incorporating exercise into dialysis care (Fiaccadori et al., 2014; Cupisti et al., 2013; Bennett & Hussein, 2021). Consequently, the limited uptake of exercise interventions should not be interpreted simply as a problem of patient adherence. Successful implementation requires changes in the organization of care and greater involvement of healthcare professionals in exercise promotion and prescription.

The evidence concerning the safety and feasibility of structured exercise programs is particularly encouraging. The reviewed studies indicate that appropriately designed interventions can improve walking capacity, muscular strength, endurance, mobility, and quality of life, while serious exercise-related adverse events were not reported in the clinical studies discussed in this review (Bennett & Hussein, 2021; Jhamb et al., 2023). These findings challenge the assumption that dialysis patients are generally too medically vulnerable to participate in physical activity. Nevertheless, safety depends on appropriate individualization, clinical assessment, supervision, and adaptation of exercise intensity to the patient's functional capacity and comorbidities. Therefore, the objective should not be to establish a single exercise program applicable to all dialysis patients, but rather to develop flexible strategies that can be adapted to individual clinical circumstances and preferences.

An important limitation of the current evidence base is the heterogeneity of exercise interventions and outcome assessment. Studies differ with regard to the type, intensity, frequency, and duration of exercise, as well as the characteristics of participants and methods used to assess physical activity and clinical outcomes. This heterogeneity makes direct comparison between studies difficult and limits the development of universally applicable recommendations. Furthermore, the reviewed literature includes observational studies as well as feasibility and interventional studies, meaning that the strength of evidence is not uniform across all reported outcomes. The limited number of large-scale clinical trials also restricts the ability to determine the long-term effects of exercise on outcomes such as mortality, hospitalization, and healthcare utilization. These limitations should be taken into consideration when interpreting the association between physical activity and improved clinical outcomes.

Future research should therefore focus on establishing more standardized and evidence-based exercise recommendations for different subgroups of dialysis patients. Further studies are needed to determine the optimal type, intensity, frequency, and duration of exercise and to clarify how exercise programs should be adapted according to age, comorbidity burden, nutritional status, dialysis modality, and baseline functional capacity. Large-scale randomized clinical trials with longer follow-up periods would also be valuable in determining whether improvements in physical functioning and quality of life translate into meaningful reductions in hospitalization and mortality. In addition, implementation research should investigate how exercise programs can be sustainably incorporated into routine dialysis care and which models of multidisciplinary cooperation are most effective.

Taken together, the findings of this review support the view that physical activity should be regarded as an integral component of comprehensive dialysis care rather than an optional supportive intervention. Its potential benefits extend across physical, nutritional, psychological, and functional domains, while the available evidence suggests that appropriately individualized exercise programs are feasible and generally safe. However, the implementation gap remains substantial. Greater patient education, professional training, multidisciplinary collaboration, and the development of standardized recommendations are necessary to translate the existing evidence into routine clinical practice. Integrating physical activity with nutritional management and other supportive interventions may provide a more comprehensive strategy for preserving functional independence and improving quality of life among patients undergoing dialysis.

5. Conclusions

Physical activity represents a fundamental component of comprehensive healthcare for patients undergoing dialysis and plays an essential role in improving both physical and psychological outcomes in this vulnerable population. The available body of evidence consistently demonstrates that regular participation in appropriately adapted physical activity provides numerous clinically relevant benefits, including improvements in cardiovascular performance, muscular strength, functional capacity, nutritional status, and overall psychological well-being. Exercise interventions have been shown to contribute to better preservation of physical independence, enhanced mobility, and improved ability to perform activities of daily living, which are particularly important outcomes in patients with end-stage kidney disease who frequently experience progressive functional decline.

Beyond its effects on physical performance, physical activity has a substantial impact on multiple aspects of patients' quality of life. Regular exercise may contribute to reductions in depressive symptoms, fatigue, and sleep disturbances, while simultaneously promoting greater self-confidence, social interaction, and a sense of control over the disease process. These psychological and social benefits are of particular importance in dialysis patients, who often experience significant limitations related to the chronic nature of their condition, dependence on regular treatment sessions, reduced participation in everyday activities, and

increased risk of social isolation. Therefore, physical activity should not be considered solely as a method of improving physical fitness but rather as a multidimensional intervention capable of positively influencing various domains of health.

Furthermore, evidence suggests that maintaining an active lifestyle may have important implications for long-term clinical outcomes. Higher levels of physical activity are associated with reduced hospitalization rates, improved functional outcomes, and lower mortality risk among dialysis patients. Conversely, insufficient physical activity contributes to a number of unfavorable consequences, including increased frailty, progressive muscle loss, impaired mobility, reduced exercise tolerance, poorer sleep quality, and deterioration of overall health status. The strong association between physical inactivity and adverse outcomes highlights the importance of recognizing physical activity as an integral element of dialysis management rather than an optional supportive intervention.

Despite the well-established benefits and favorable safety profile of exercise interventions, the implementation of structured physical activity programs in routine dialysis care remains limited. Significant barriers continue to exist at both the individual patient level and within healthcare systems. Patients may experience difficulties initiating or maintaining physical activity due to fatigue, multiple comorbidities, fear of injury, reduced motivation, psychological distress, and uncertainty regarding the appropriate type and intensity of exercise. At the same time, healthcare-related barriers, including insufficient professional training, limited resources, lack of standardized protocols, and inadequate institutional support, continue to restrict the widespread incorporation of exercise programs into dialysis practice.

Overcoming these challenges requires a multifaceted approach involving patient education, healthcare professional training, improved communication between members of multidisciplinary teams, and the development of integrated models of care. Increasing patient awareness regarding the safety and benefits of physical activity may help overcome misconceptions and improve motivation, while enhanced education of healthcare providers may facilitate more confident exercise prescription and monitoring. The involvement of nephrologists, nurses, physiotherapists, dietitians, and rehabilitation specialists is essential for creating individualized and sustainable exercise strategies tailored to patients' functional abilities, clinical conditions, and personal needs.

An additional important aspect highlighted by current evidence is the close and mutually reinforcing relationship between nutritional status and physical activity. Dialysis patients are particularly susceptible to protein-energy wasting, loss of muscle mass, and deterioration of nutritional status, all of which negatively affect exercise capacity and functional independence. At the same time, regular physical activity may contribute to improved appetite, preservation of lean body mass, enhanced metabolic function, and better utilization of nutrients. Therefore, interventions focusing exclusively on either nutritional support or exercise may not provide optimal results. Comprehensive approaches combining individualized dietary management with structured physical activity programs are likely to be the most effective strategy for improving overall health outcomes and preventing physical decline.

Although existing research strongly supports the integration of exercise into dialysis care, further studies are needed to address remaining knowledge gaps and facilitate broader clinical implementation. Future research should focus on establishing standardized recommendations regarding exercise type, intensity, frequency, duration, and methods of monitoring in different subgroups of dialysis patients. Large-scale clinical trials are also needed to further evaluate the long-term effects of exercise interventions on survival, hospitalization rates, quality of life, and healthcare utilization.

In conclusion, promoting and facilitating physical activity should become a cornerstone of holistic and patient-centered care for individuals undergoing dialysis therapy. Exercise represents a safe, effective, and accessible intervention with the potential to improve multiple dimensions of health, from physical functioning and nutritional status to psychological well-being and social participation. Future clinical efforts should prioritize the development of sustainable, individualized, and multidisciplinary exercise programs while simultaneously addressing existing organizational and patient-related barriers. Integrating physical activity into routine dialysis management may significantly contribute to improving quality of life, preserving functional independence, and achieving better long-term outcomes in this high-risk patient population.

Author Contributions:**Conceptualization:** Julia Wójcik,**Methodology:** Julia Wójcik, Zuzanna Głowacka**Software:** Zuzanna Głowacka**Check:** Julia Wójcik**Formal analysis:** Julia Wójcik, Zuzanna Głowacka**Investigation:** Julia Wójcik**Data curation:** Zuzanna Głowacka**Writing - rough preparation:** Julia Wójcik**Writing - review and editing:** Julia Wójcik**Visualization:** Julia Wójcik, Zuzanna Głowacka

All authors have read to the published version of the manuscript

Funding Statement: This research received no external funding.**Acknowledgements:** The authors have no acknowledgements to declare**Data Availability Statement:** The data supporting the findings of this study are available within the article.**Conflicts of Interest:** The authors declare no conflict of interest

Declaration of the use of generative AI and AI-assisted technologies in the writing process: In preparing this work, the author(s) used ChatGPT for the purpose of translation. After using this tool/service, the author(s) have reviewed and edited the content as needed and accept full responsibility for the substantive content of the publication

REFERENCES

1. Amann, K., & Halle, M. (2006). Prävention und Therapie der renalen Insuffizienz: Sport schützt auch die Niere [Physical activity in patients with renal insufficiency and patients on dialysis]. *MMW Fortschritte der Medizin*, 148(38), 37–38, 40.
2. Anand, S., Chertow, G. M., Johansen, K. L., Grimes, B., Kurella Tamura, M., Dalrymple, L. S., & Kaysen, G. A. (2011). Association of self-reported physical activity with laboratory markers of nutrition and inflammation: The Comprehensive Dialysis Study. *Journal of Renal Nutrition*, 21(6), 429–437. <https://doi.org/10.1053/j.jrn.2010.09.007>
3. Anand, S., Johansen, K. L., Grimes, B., Kaysen, G. A., Dalrymple, L. S., Kutner, N. G., & Chertow, G. M. (2013). Physical activity and self-reported symptoms of insomnia, restless legs syndrome, and depression: The Comprehensive Dialysis Study. *Hemodialysis International*, 17(1), 50–58. <https://doi.org/10.1111/j.1542-4758.2012.00726.x>
4. Bennett, P. N., & Hussein, W. F. (2021). The safety of peritoneal dialysis physical activity programs in the era of advancing American Kidney Health. *Kidney Medicine*, 3(6), 1099. <https://doi.org/10.1016/j.xkme.2020.05.016>
5. Bennett, P. N., Hussein, W. F., Matthews, K., West, M., Smith, E., Reiterman, M., Alagadan, G., Shragge, B., Patel, J., & 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>
6. Bennett, P. N., Thompson, S., & Wilund, K. R. (2019). An introduction to exercise and physical activity in dialysis patients: Preventing the unacceptable journey to physical dysfunction. *Seminars in Dialysis*, 32(4), 281–282. <https://doi.org/10.1111/sdi.12816>
7. Cai, H., Wu, Z., Xu, J., Wang, T., Li, Y., Jiang, Y., & Xu, M. (2024). Mitigating social isolation among peritoneal dialysis patients: The impact of educational level, physical activity, and familial support. *Risk Management and Healthcare Policy*, 17, 2271–2280. <https://doi.org/10.2147/RMHP.S479130>
8. Caselli, E., Fabbri, C., D'Accolti, M., Soffritti, I., Bassi, C., Mazzacane, S., & Franchi, M. (2020). Defining the oral microbiome by whole-genome sequencing and resistome analysis: The complexity of the healthy picture. *BMC Microbiology*, 20, Article 120. <https://doi.org/10.1186/s12866-020-01801-y>
9. Cobo, G., Gallar, P., Gama-Axelsson, T., Di Gioia, C., Qureshi, A. R., Camacho, R., Vigil, A., Heimbürger, O., Ortega, O., Rodriguez, I., Herrero, J. C., Bárány, P., Lindholm, B., Stenvinkel, P., & Carrero, J. J. (2015). Clinical determinants of reduced physical activity in hemodialysis and peritoneal dialysis patients. *Journal of Nephrology*, 28(4), 503–510. <https://doi.org/10.1007/s40620-014-0164-y>

10. Cupisti, A., Capitanini, A., Betti, G., D'Alessandro, C., & Barsotti, G. (2011). Assessment of habitual physical activity and energy expenditure in dialysis patients and relationships to nutritional parameters. *Clinical Nephrology*, 75(3), 218–225. <https://doi.org/10.5414/cnp75218>
11. Cupisti, A., D'Alessandro, C., Bottai, A., Fumagalli, G., & Capitanini, A. (2013). Physical activity and exercise training: A relevant aspect of the dialysis patient's care. *Internal and Emergency Medicine*, 8(Suppl. 1), S31–S34. <https://doi.org/10.1007/s11739-013-0917-y>
12. Cupisti, A., D'Alessandro, C., Finato, V., Del Corso, C., Catania, B., Caselli, G. M., & Egidi, M. F. (2017). Assessment of physical activity, capacity and nutritional status in elderly peritoneal dialysis patients. *BMC Nephrology*, 18, Article 180. <https://doi.org/10.1186/s12882-017-0593-7>
13. da Costa Rosa, C. S., Nishimoto, D. Y., Freitas Júnior, I. F., Ciolac, E. G., & Monteiro, H. L. (2017). Factors associated with levels of physical activity in chronic kidney disease patients undergoing hemodialysis: The role of dialysis versus nondialysis day. *Journal of Physical Activity and Health*, 14(9), 726–732. <https://doi.org/10.1123/jpah.2016-0715>
14. Fiaccadori, E., Sabatino, A., Schito, F., Angella, F., Malagoli, M., Tucci, M., Cupisti, A., Capitanini, A., & Regolisti, G. (2014). Barriers to physical activity in chronic hemodialysis patients: A single-center pilot study in an Italian dialysis facility. *Kidney and Blood Pressure Research*, 39(2–3), 169–175. <https://doi.org/10.1159/000355793>
15. Greenwood, S. (2017). Do we need tailored physical interventions to improve physical function and physical activity levels in patients with chronic kidney disease treated with peritoneal dialysis? *Peritoneal Dialysis International*, 37(6), 595–597. <https://doi.org/10.3747/pdi.2017.00138>
16. Isnard-Rouchon, M., West, M., & Bennett, P. N. (2019). Exercise and physical activity for people receiving peritoneal dialysis: Why not? *Seminars in Dialysis*, 32(4), 303–307. <https://doi.org/10.1111/sdi.12784>
17. Jagannathan, R., Ziolkowski, S. L., Weber, M. B., Cobb, J., Pham, N., Long, J., Anand, S., & Lobelo, F. (2018). Physical activity promotion for patients transitioning to dialysis using the “Exercise is Medicine” framework: A multi-center randomized pragmatic trial (EIM-CKD trial) protocol. *BMC Nephrology*, 19, Article 230. <https://doi.org/10.1186/s12882-018-1032-0>
18. Janeiro, D., Portolés, J., Tato, A. M., López-Sánchez, P., Del Peso, G., Rivera, M., Castellano, I., Fernández-Reyes, M. J., Pérez-Gómez, V., Ortega, M., Martínez-Miguel, P., Felipe, C., Caparrós, G., Ortiz, A., & Selgas, R. (2015). Peritoneal dialysis can be an option for dominant polycystic kidney disease: An observational study. *Peritoneal Dialysis International*, 35(5), 530–536. <https://doi.org/10.3747/pdi.2014.00029>
19. Jhamb, M., Devaraj, S. M., Alemairi, M., Lavenburg, L. M., Shiva, S., Yabes, J. G., Forman, D. E., & Hergenroeder, A. L. (2023). A comprehensive exercise (COMEX) intervention to optimize exercise participation for improving patient-centered outcomes and physical functioning in patients receiving hemodialysis: Development and pilot testing. *Kidney Medicine*, 5(11), Article 100720. <https://doi.org/10.1016/j.xkme.2023.100720>
20. Johansen, K. L., Chertow, G. M., Kutner, N. G., Dalrymple, L. S., Grimes, B. A., & Kaysen, G. A. (2010). Low level of self-reported physical activity in ambulatory patients new to dialysis. *Kidney International*, 78(11), 1164–1170. <https://doi.org/10.1038/ki.2010.312>
21. Johansen, K. L., Kaysen, G. A., Dalrymple, L. S., Grimes, B. A., Glidden, D. V., Anand, S., & Chertow, G. M. (2013). Association of physical activity with survival among ambulatory patients on dialysis: The Comprehensive Dialysis Study. *Clinical Journal of the American Society of Nephrology*, 8(2), 248–253. <https://doi.org/10.2215/CJN.08560812>
22. Kang, S. H., Do, J. Y., Jeong, H. Y., Lee, S. Y., & Kim, J. C. (2017). The clinical significance of physical activity in maintenance dialysis patients. *Kidney and Blood Pressure Research*, 42(3), 575–586. <https://doi.org/10.1159/000480674>
23. Kim, J. C., Young Do, J., & Kang, S. H. (2021). Comparisons of physical activity and understanding of the importance of exercise according to dialysis modality in maintenance dialysis patients. *Scientific Reports*, 11, Article 21487. <https://doi.org/10.1038/s41598-021-00924-0>
24. Kolko Labadens, A., Lasseur, C., Labat, T., Trolonge, S., & Chauveau, P. (2014). Activité physique chez les patients dialysés: Comment et pourquoi l'évaluer et mettre en place un programme? [Physical activity in dialysis population: How and why to assess and establish a program?]. *Néphrologie & Thérapeutique*, 10(3), 151–158. <https://doi.org/10.1016/j.nephro.2013.12.004>
25. Lambert, K., Lightfoot, C. J., Jegatheesan, D. K., Gabrys, I., & Bennett, P. N. (2022). Physical activity and exercise recommendations for people receiving dialysis: A scoping review. *PLOS ONE*, 17(4), Article e0267290. <https://doi.org/10.1371/journal.pone.0267290>

26. Majchrzak, K. M., Pupim, L. B., Chen, K., Martin, C. J., Gaffney, S., Greene, J. H., & Ikizler, T. A. (2005). Physical activity patterns in chronic hemodialysis patients: Comparison of dialysis and nondialysis days. *Journal of Renal Nutrition*, 15(2), 217–224. <https://doi.org/10.1053/j.jrn.2004.08.002>
27. Stack, A. G., & Murthy, B. (2008). Exercise and limitations in physical activity levels among new dialysis patients in the United States: An epidemiologic study. *Annals of Epidemiology*, 18(12), 880–888. <https://doi.org/10.1016/j.annepidem.2008.09.008>
28. Stack, A. G., Molony, D. A., Rives, T., Tyson, J., & Murthy, B. V. (2005). Association of physical activity with mortality in the US dialysis population. *American Journal of Kidney Diseases*, 45(4), 690–701. <https://doi.org/10.1053/j.ajkd.2004.12.013>
29. Thangarasa, T., Imtiaz, R., Hiremath, S., & Zimmerman, D. (2018). Physical activity in patients treated with peritoneal dialysis: A systematic review and meta-analysis. *Canadian Journal of Kidney Health and Disease*, 5, Article 2054358118779821. <https://doi.org/10.1177/2054358118779821>