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# Physical Activity in Patients with Chronic Kidney Disease: A Narrative Review

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## ABSTRACT

**Background.** Chronic kidney disease (CKD) is a growing public health problem and is associated with a significant reduction in quality of life. Patients with CKD often experience fatigue and reduced participation in daily activities. In recent years, increasing attention has been given to the role of physical activity as a supportive strategy in the management of CKD.

**Aim.** This review aimed to analyze current evidence on the effects of physical activity in patients with CKD.

**Material and methods.** The narrative review of the literature from 2020 onwards and was performed using databases including PubMed and MEDLINE. Older landmark studies were also included when considered essential for this narrative review.

**Results.** Current findings suggest that physical activity should be regarded as an important component of CKD management. Promoting regular exercise may improve health outcomes in this patient population. Further studies are required to identify the most effective exercise strategies among individuals with CKD.

**Conclusions.** Regular physical activity may provide substantial benefits for patients with chronic kidney disease. Exercise interventions have been associated with better functional performance in both non-dialysis and dialysis populations. However, physical activity levels remain low among individuals with CKD due to several barriers.

**Key words:** chronic kidney disease, physical activity, exercise training, renal rehabilitation

## 1. INTRODUCTION

Chronic kidney disease affects up to 15% of the global population and represents a growing healthcare burden. The disease is characterized by a progressive decline in kidney function and is associated with numerous complications, including cardiovascular disease, metabolic disturbances, sarcopenia, anemia, and reduced exercise tolerance. These are related to impaired quality of life and premature mortality. Consequently, improving functional capacity and overall health status has become an important therapeutic objective alongside the preservation of renal function. [1, 4]

Physical inactivity is highly prevalent among patients with CKD and becomes increasingly pronounced as kidney function deteriorates. They are substantially less active than age-matched healthy populations and frequently fail to meet recommended physical activity guidelines. This sedentary lifestyle further accelerates functional decline, creating a vicious cycle associated with poorer clinical outcomes. Over the past decade, growing evidence has demonstrated that physical activity and structured exercise training can provide significant benefits across all stages of CKD. Aerobic, resistance, and combined exercise programs have been associated with improvements in cardiorespiratory fitness, muscle strength, exercise capacity, and health-related quality of life. [2, 6]

Despite these promising findings, the implementation of exercise interventions in routine nephrology practice remains limited. In addition, barriers at both patient and healthcare-system levels continue to hinder the integration of physical activity into standard CKD care. As a consequence, many patients do not receive structured guidance regarding exercise despite increasing recognition of its therapeutic value. [2, 17]

Recent consensus statements and clinical recommendations have highlighted physical activity as a fundamental component of holistic CKD management. Therefore, the aim of this review is to provide a comprehensive overview of the current evidence regarding physical activity and exercise in patients with chronic kidney disease, focusing on their effects on physical performance, cardiovascular health, quality of life, and overall clinical outcomes.

## 2. CHRONIC KIDNEY DISEASE AND PHYSICAL FUNCTION DECLINE

Chronic kidney disease is associated with a progressive decline in physical function that begins in the early stages of the disease and becomes increasingly pronounced as kidney function deteriorates, with the lowest levels observed among patients with advanced CKD and those receiving dialysis treatment. This is driven by the complex interplay of metabolic, cardiovascular, musculoskeletal, and neurological abnormalities. Compared with healthy individuals, patients with CKD engage in substantially lower amounts of moderate-to-vigorous physical activity and spend a greater proportion of their time in sedentary behaviors. As kidney function declines, patients increasingly experience symptoms such as fatigue, reduced exercise tolerance, dyspnea, muscle weakness, sleep disturbances, depressive symptoms, and chronic pain. These manifestations substantially limit the ability to perform activities of daily living and contribute to a marked reduction in overall physical activity levels. [4, 5, 13]

Physical activity levels vary considerably across different stages of CKD and treatment modalities. Individuals with earlier CKD stages generally maintain higher levels of physical activity and better physical function. Among all CKD populations, patients undergoing dialysis are consistently reported to be the least physically active. Hemodialysis treatment imposes additional barriers to regular physical activity, including prolonged periods of inactivity during dialysis sessions, post-dialysis fatigue, transportation requirements, and treatment-related symptoms. Consequently, dialysis patients often exhibit lower daily step counts, reduced participation in moderate-to-vigorous physical activity, and greater sedentary time compared with non-dialysis CKD patients. Furthermore, physical activity levels tend to be lower on dialysis days than on non-dialysis days, highlighting the impact of treatment burden on daily activity patterns. [8, 23, 25]

Several pathophysiological mechanisms underlie functional impairment in CKD. Chronic low-grade inflammation, anemia, vitamin D deficiency, hormonal dysregulation, and the accumulation of uremic toxins promote skeletal muscle wasting and impair muscle metabolism. Consequently, patients frequently develop sarcopenia, characterized by a progressive loss of muscle mass, strength, and physical performance. Additionally, cardiovascular comorbidities, which are highly prevalent in CKD, further compromise exercise capacity through reduced aerobic fitness and impaired oxygen delivery to peripheral tissues. Reduced gait speed, lower handgrip strength, impaired balance, and decreased cardiorespiratory fitness have consistently been reported in this population. Importantly, these impairments are associated with increased risks of hospitalization, frailty, disability, cardiovascular events, and all-cause mortality. [6, 18]

The burden of CKD-related symptoms frequently results in avoidance of physical activity, leading to a sedentary lifestyle that further exacerbates muscle atrophy and functional deterioration. This creates a self-perpetuating cycle in which declining physical function contributes to reduced activity levels, while inactivity accelerates further losses in muscle strength and exercise capacity. This is related to frailty, loss of functional independence, and poorer health outcomes. Consequently, preserving physical function has emerged as a key therapeutic target in CKD management, highlighting the importance of early assessment and interventions aimed at maintaining mobility, muscle strength, and overall functional capacity. [3, 9, 24]

## 3. BENEFITS OF PHYSICAL ACTIVITY IN CHRONIC KIDNEY DISEASE

Physical activity has emerged as an essential non-pharmacological component of chronic kidney disease management. A growing body of evidence demonstrates that exercise provides a lot of benefits across all stages of CKD, improving not only physical function but also overall health and clinical outcomes.

Health-related quality of life is an important domain that consistently benefits from exercise interventions. Improvements are particularly evident in physical functioning and disease-specific quality-of-life measures, reflecting enhanced mobility, reduced symptom burden and greater functional independence. Higher levels of physical activity are associated with a lower prevalence of frailty, whereas prolonged sedentary time is linked to an increased risk. Notably, the relationship between sedentary behavior and frailty appears to be dose-dependent, with the risk increasing substantially after prolonged periods of daily sedentary time. [5, 13, 24] Regular training also plays a particularly important role in preserving muscle mass. Progressive resistance exercise stimulates muscle protein synthesis, promotes muscle hypertrophy through activation of anabolic signaling pathways and may increase the production of anabolic hormones, thereby counteracting muscle wasting and sarcopenia. [22, 23]

Numerous studies have demonstrated that regular training enhances cardiorespiratory fitness. Aerobic and resistance exercise have been associated with significant reductions in both systolic and diastolic blood pressure, with resistance exercise combined with blood flow restriction demonstrating the greatest effects. Current evidence suggests that regular exercise is associated with lower cardiovascular mortality and a reduced incidence of major cardiovascular events, including myocardial infarction, stroke, heart failure, and cardiovascular death. These benefits are likely mediated through improvements in endothelial function, reductions in chronic inflammation, increased hemoglobin levels and favorable effects on traditional cardiovascular risk factors. In addition, exercise has been linked to reductions in body mass index and waist circumference, suggesting favorable effects on body composition. [10, 16, 17] Regular physical activity is associated also with enhanced pulmonary function. In particular, eccentric cycling has been reflected by increases in peak oxygen uptake ($VO_2$peak), as well as improvements in spirometric parameters, including forced expiratory volume in one second ($FEV_1$) and forced vital capacity (FVC). Furthermore, exercise interventions have been shown to enhance respiratory muscle performance by increasing diaphragmatic function and inspiratory muscle strength, while preserving expiratory muscle function. Combined aerobic and resistance exercise appears to be the most effective strategy for improving cardiorespiratory fitness. [5, 7, 15]

Physical activity may also exert favorable effects on systemic inflammation and nutritional status. Several studies report reductions in inflammatory markers, particularly C-reactive protein (CRP) and interleukin-6 (IL-6), suggesting that exercise may help attenuate the chronic low-grade inflammation characteristic of CKD. While reductions in CRP have been observed in both dialysis-dependent and non-dialysis patients, improvements in IL-6 appear to be more pronounced in individuals with non-dialysis CKD. Anti-inflammatory effects of exercise may vary according to the type of training performed. Resistance training appears to exert the most consistent beneficial effects on inflammatory status, leading to significant reductions in pro-inflammatory biomarkers. Aerobic exercise and combined aerobic-resistance training have also been associated with decreased concentrations of inflammatory mediators, including C-reactive protein (CRP), interleukin-6 (IL-6), and tumor necrosis factor-α (TNF-α), together with increased levels of the anti-inflammatory cytokine interleukin-10 (IL-10). Importantly, these anti-inflammatory benefits have been observed in both dialysis-dependent and non-dialysis CKD populations. Current evidence also suggests increases in hemoglobin and serum albumin concentrations following structured exercise programs. Improvements in hemoglobin have been observed across different CKD populations, whereas increases in serum albumin appear to be more evident among patients receiving dialysis. These findings suggest that regular physical activity may contribute not only to enhanced physical function but also to improvements in systemic inflammation and nutritional status. [4, 7, 9, 18]

Emerging evidence suggests that exercise training may also exert beneficial effects through modulation of the gut microbiota. Exercise has been associated with increased microbial diversity and a higher abundance of beneficial bacteria involved in short-chain fatty acid production, particularly butyrate-producing species. These changes may contribute to reduced systemic inflammation, improved metabolic homeostasis and lower cardiovascular risk, which are particularly relevant in patients with CKD. Although these findings are promising, the evidence in patients with CKD remains limited. [21]

## 4. EXERCISE RECOMMENDATIONS FOR PATIENTS WITH CHRONIC KIDNEY DISEASE

Current clinical guidelines recommend regular exercise as an integral component of CKD management. Exercise prescriptions should be individualized according to disease stage, functional capacity and treatment modality to maximize benefits while ensuring patient safety. Several strategies have been proposed to improve adherence to training in CKD. These include educating patients about the benefits of regular physical activity, identifying modifiable barriers, promoting gradual behavioural change, and providing structured supervision when appropriate.

Regular physical activity is generally considered safe for most individuals with CKD when exercise programs are appropriately prescribed and supervised. Although some studies have reported exercise-related adverse events, these were uncommon. Episodes of intradialytic hypotension are the most frequently reported complication, particularly during high-intensity exercise. In contrast, moderate-intensity exercise has consistently demonstrated a favorable safety profile. Also isolated cases of abdominal wall complications, such as hernias or dialysate leaks, have been described in patients performing exercise during peritoneal dialysis, severe adverse events remain uncommon. Strengthening of the abdominal musculature may even reduce susceptibility to these complications. [1, 4]

Assessment of physical function represents a fundamental component of exercise prescription. Current recommendations emphasize that functional capacity should be evaluated at least annually and prior to initiating an exercise intervention to facilitate individualized exercise prescription and monitor treatment effectiveness over time. Objective performance-based assessments provide valuable information regarding aerobic capacity, muscle strength, balance, and mobility. Among the most widely recommended tools are:

- the Six-Minute Walk Test (6MWT), which evaluates functional aerobic capacity,
- the Sit-to-Stand (STS) test, assessing lower-limb strength and functional independence,
- the Short Physical Performance Battery (SPPB), which integrates measures of gait speed, chair-rise performance, and static balance.

These assessments have demonstrated strong prognostic value, with lower performance consistently associated with increased risks of hospitalization and mortality among individuals with CKD. The SPPB has emerged as one of the most comprehensive measures because it simultaneously evaluates multiple domains of physical performance and reliably predicts adverse clinical outcomes. Consequently, routine incorporation of these functional assessments into nephrology practice enables early identification of patients at increased risk of frailty, disability, and poor clinical outcomes while facilitating timely implementation of targeted rehabilitation strategies. [2, 6, 11]

Exercise prescription in patients with CKD should be individualized according to the patient's clinical condition. Current recommendations generally follow the fundamental FITT-VP principles (frequency, intensity, time, type, volume, and progression) and are largely consistent with physical activity guidelines for the general population. In clinically stable patients without contraindications, at least 150–300 minutes of moderate-intensity aerobic activity or 75–150 minutes of vigorous-intensity activity per week is recommended, together with muscle-strengthening, balance, and flexibility exercises performed on at least two days per week. Aerobic exercise should preferably include rhythmic activities involving large muscle groups, such as walking, cycling, or swimming. Resistance training should target the major muscle groups using free weights, resistance bands, weight machines, or body-weight exercises. For novice and intermediate participants, resistance exercise is generally recommended at 60–70% of one-repetition maximum (1RM), corresponding to approximately 8–12 repetitions per set, while lower intensities (40–50% 1RM) may be more appropriate for frail, older, or functionally impaired individuals. Aerobic sessions should ideally last 20–60 minutes. However, patients unable to tolerate continuous exercise may benefit from intermittent bouts of 3-5 minutes with appropriate rest intervals. Exercise intensity should initially remain low to moderate and progress gradually according to individual tolerance, with increases in exercise volume preceding increases in intensity to minimize the risk of injury, excessive fatigue and poor adherence. Although heart rate–based exercise prescription may be appropriate in selected individuals, subjective assessment using the Borg Rating of Perceived Exertion (RPE) scale is often preferred in clinical practice because many patients receive medications that alter heart rate responses or present with cardiovascular limitations. Importantly, even modest increases in daily physical activity, including replacing sedentary behaviour with light-intensity activities and increasing daily step counts, may provide clinically meaningful health benefits, particularly in patients with advanced CKD or reduced functional capacity. Current evidence consistently demonstrates that regular exercise improves health-related quality of life, while also reducing symptoms of anxiety and depression. A combination of aerobic and resistance exercise is therefore considered the preferred strategy for optimizing physical function and overall health outcomes in patients with CKD. Exercise programmes may be performed at home, in community or sports facilities, or during dialysis sessions. Furthermore, digital health interventions, including telehealth platforms and wearable technologies, are increasingly recognized as valuable tools for promoting long-term exercise adherence through education, behavioural support, goal setting, and activity monitoring. [6, 9, 12, 14]

Dietary modification is an essential component of CKD management. Patients are commonly advised to reduce protein intake, while sodium, phosphorus, and potassium intake should be adjusted according to disease stage, laboratory findings, and individual clinical needs. However nutritional management should not be viewed as a barrier to exercise participation. Although low-protein diets are commonly prescribed for patients with non-dialysis CKD, current evidence indicates that protein restriction does not diminish the beneficial effects of resistance exercise on muscle mass, strength, or nutritional status when adequate energy intake is maintained. Clinical trials have demonstrated that resistance training performed alongside a low-protein diet improves muscle fiber size, mitochondrial content and markers of nutritional status. These findings suggest that appropriately prescribed resistance exercise remains an effective strategy for counteracting sarcopenia and physical decline even in patients following dietary protein restriction, further supporting the integration of exercise into comprehensive CKD management. [19, 20]

Monitoring habitual physical activity is recommended to identify sedentary behavior and evaluate adherence to exercise recommendations. Validated self-report instruments, including the Global Physical Activity Questionnaire (GPAQ), Physical Activity Vital Signs (PAVS), and the Human Activity Profile (HAP), provide practical methods for estimating daily physical activity in patients with CKD. Among these, HAP demonstrates particularly strong agreement with accelerometry and has been shown to predict both quality of life and mortality in dialysis populations. However, because extensive questionnaires may reduce long-term adherence, wearable technologies such as accelerometers, pedometers, smartwatches, and heart-rate monitors are increasingly recommended as objective tools for continuous monitoring. These devices not only improve the accuracy of physical activity assessment but may also enhance patient motivation and promote long-term engagement in regular exercise. [1, 6, 13]

## 5. PHYSICAL ACTIVITY DURING HEMODIALYSIS SESSIONS

Physical activity is significantly reduced among patients requiring renal replacement therapy. Although dialysis remains a life-sustaining treatment, individuals are particularly vulnerable to physical impairment and functional decline. In recent years, growing evidence has highlighted the benefits of intradialytic exercise as an effective strategy to counteract these adverse consequences. Improvements have been observed in functional measures such as walking capacity, sit-to-stand performance and handgrip strength, suggesting a positive effect on overall physical functioning and independence. [12, 26, 28]

Clinical recommendations suggest that intradialytic exercise should be individualized according to the patient's physical capacity and overall clinical condition. Exercise programs typically combine aerobic and resistance training and are most commonly performed during the first two hours of the hemodialysis session, when the risk of intradialytic complications is lower. Aerobic exercise is usually conducted using a stationary cycle ergometer attached to the dialysis chair, whereas resistance training may involve elastic bands, ankle weights, or light free weights targeting major muscle groups. Most guidelines recommend moderate-intensity exercise, with gradual progression based on patient tolerance and regular monitoring of symptoms, blood pressure, and heart rate. Exercise sessions should be guided by trained healthcare professionals to ensure safety. Compared with home-based exercise programs, intradialytic training may achieve higher adherence rates due to direct supervision and integration into routine dialysis care. [27, 28]

Numerous studies have demonstrated that exercise performed during hemodialysis sessions can improve a patient's quality of life. Current evidence suggests that intradialytic exercise may provide important cardiovascular benefits. It has been associated with improvements in arterial stiffness, blood pressure control, cardiac function, and autonomic nervous system regulation. Importantly, the observed benefits appear to be dependent on continued participation, suggesting that long-term adherence to exercise programs is necessary to maintain favorable cardiovascular adaptations. Some evidence also indicates that patients in earlier stages of dialysis treatment may derive greater cardiovascular benefits than those receiving long-term hemodialysis. Additionally, intradialytic exercise may reduce fatigue and depressive symptoms while also improving frailty status. This contributes to better physical function and quality of life. These benefits are likely mediated through improvements in muscle mass and functional capacity. Another important advantage of intradialytic exercise is its positive effect on physical activity behavior. By improving muscle function exercise interventions may encourage patients to adopt a more active lifestyle and reduce sedentary behavior outside dialysis sessions. [26, 27, 28]

## 6. FUTURE DIRECTIONS

Despite the growing body of evidence supporting the benefits of physical activity and exercise in patients with chronic kidney disease, several important challenges remain. Current studies are characterized by substantial heterogeneity in exercise modalities, intensity, frequency, duration, and outcome measures, making it difficult to establish standardized exercise prescriptions for different CKD populations. Future research should focus on identifying the most effective exercise strategies according to disease stage, treatment modality, age, comorbidities, and functional status.

Further large-scale, high-quality randomized controlled trials are needed to evaluate the long-term effects of physical activity on clinically relevant outcomes, including CKD progression, cardiovascular events, hospitalization rates, and mortality. Another important area for future investigation is the development of strategies aimed at improving exercise adherence. Although the benefits of physical activity are well documented, participation rates among patients with CKD remain low. The integration of exercise counseling into routine nephrology care, multidisciplinary exercise programs and personalized activity monitoring may help overcome existing barriers and promote long-term engagement in physical activity. [2, 3, 5, 8]

## 7. CONCLUSIONS

Chronic kidney disease is associated with a progressive decline in physical function and a substantial reduction in physical activity levels, which contribute to poorer quality of life and adverse clinical outcomes. Multiple CKD-related factors, including fatigue, muscle wasting, frailty, cardiovascular comorbidities, and reduced exercise tolerance, promote sedentary behavior and further exacerbate functional impairment. Current evidence consistently demonstrates that regular physical activity and structured exercise training are safe and effective interventions for patients with CKD across different disease stages and treatment modalities. Exercise has been shown to improve physical performance, muscle strength, cardiorespiratory fitness, functional capacity, and health-related quality of life. Emerging evidence also suggests potential benefits for cardiovascular health and long-term clinical outcomes. Among dialysis patients, intradialytic exercise represents a particularly promising strategy for increasing physical activity and improving overall health status. Despite these well-established benefits, physical inactivity remains highly prevalent in the CKD population, and exercise is still underutilized in routine nephrology care. Therefore, promoting physical activity should be considered a fundamental component of comprehensive CKD management. Integrating exercise assessment and counseling into standard clinical practice may contribute to better functional outcomes, enhanced quality of life, and improved long-term prognosis for patients with chronic kidney disease.

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In preparing this work, the authors used ChatGPT for the purpose of language editing and improvement of grammar. After using this tool, the authors have reviewed and edited the content as needed and accept full responsibility for the substantive content of the publication.

## REFERENCES


1. Battaglia Y, Baciga F, Bulighin F, et al. Physical activity and exercise in chronic kidney disease: consensus statements from the Physical Exercise Working Group of the Italian Society of Nephrology. *J Nephrol*. 2024;37(7):1735-1765. doi:10.1007/s40620-024-02049-9
2. Wilkinson TJ, Tarca B, Lightfoot CJ, et al. Prescribing Physical Activity and Exercise for People with CKD. *Clinical Journal of the American Society of Nephrology*. 2025;20(6):876-888. doi:10.2215/CJN.0000000708
3. Castle EM, Billany RE, Lightfoot CJ, et al. Exercise as a therapeutic intervention in chronic kidney disease: are we nearly there yet? *Curr Opin Nephrol Hypertens*. 2023;32(6):502-508. doi:10.1097/MNH.0000000000000923
4. Barcellos FC, Santos IS, Umpierre D, Bohlke M, Hallal PC. Effects of exercise in the whole spectrum of chronic kidney disease: a systematic review. *Clin Kidney J*. 2015;8(6):753-765. doi:10.1093/ckj/sfv099
5. Villanego F, Naranjo J, Vigara LA, et al. Impact of physical exercise in patients with chronic kidney disease: Systematic review and meta-analysis. *Nefrología*. 2020;40(3):237-252. doi:10.1016/j.nefro.2020.01.002
6. Baker LA, March DS, Wilkinson TJ, et al. Clinical practice guideline exercise and lifestyle in chronic kidney disease. *BMC Nephrol*. 2022;23(1):75. doi:10.1186/s12882-021-02618-1
7. Chen Y, Ren S, Yao X, et al. Benefits of physical exercises in chronic kidney disease: a systematic review and meta-analysis of randomized controlled trials. *Ren Fail*. 2026;48(1). doi:10.1080/0886022X.2026.2654288
8. Boom D, Öztürk E, Mullens M, Noelmans J, Hemmelder MH, Kooman JP. Physical activity patterns in chronic kidney disease. *BMC Nephrol*. Published online May 25, 2026. doi:10.1186/s12882-026-05026-5

9. Letton ME, Trần TB, Flower S, et al. Digital Physical Activity and Exercise Interventions for People Living with Chronic Kidney Disease: A Systematic Review of Health Outcomes and Feasibility. *J Med Syst*. 2024;48(1):63. doi:10.1007/s10916-024-02081-z

10. Beetham KS, Krishnasamy R, Stanton T, et al. Effect of a 3-Year Lifestyle Intervention in Patients with Chronic Kidney Disease: A Randomized Clinical Trial. *Journal of the American Society of Nephrology*. 2022;33(2):431-441. doi:10.1681/ASN.2021050668

11. Li W, Lin X, Cai X, et al. Exercise modality and dose effects on renal function in non–dialysis chronic kidney disease: a Bayesian model-based network meta-analysis. *BMC Nephrol*. 2026;27(1):327. doi:10.1186/s12882-026-04977-z

12. Lambert K, Lightfoot CJ, Jegatheesan DK, Gabrys I, Bennett PN. Physical activity and exercise recommendations for people receiving dialysis: A scoping review. *PLoS One*. 2022;17(4):e0267290. doi:10.1371/journal.pone.0267290

13. Clarkson MJ, Bennett PN, Fraser SF, Warmington SA. Exercise interventions for improving objective physical function in patients with end-stage kidney disease on dialysis: a systematic review and meta-analysis. *American Journal of Physiology-Renal Physiology*. 2019;316(5):F856-F872. doi:10.1152/ajprenal.00317.2018

14. Uchiyama K, Adachi K, Muraoka K, et al. Home-based aerobic exercise and resistance training for severe chronic kidney disease: a randomized controlled trial. *J Cachexia Sarcopenia Muscle*. 2021;12(6):1789-1802. doi:10.1002/jcsm.12775

15. Huang YT, Lee HY, Cheng HC, et al. Eccentric Cycling Improves Cardiopulmonary Fitness, Respiratory Function, and Quality of Life in Chronic Kidney Disease: A Randomized Controlled Trial. *Ann Rehabil Med*. 2026;50(2):105-116. doi:10.5535/arm.250163

16. Zheng Q, Sun N, Yang H, et al. Effects of different exercises on renal and cardiovascular function in adult patients with chronic kidney disease not receiving dialysis: a network meta-analysis. *BMC Nephrol*. 2026;27(1):276. doi:10.1186/s12882-026-04888-z

17. Patiño-Cardona S, Pascual-Morena C, Lucerón-Lucas-Torres M, et al. Association Between Physical Activity Levels and Mortality and Cardiovascular Disease in Chronic Kidney Disease: A Protocol for a Systematic Review and Meta-Analysis. *J Clin Med*. 2026;15(5):1983. doi:10.3390/jcm15051983

18. Khalafi M, Fatolahi S, Fini EM, et al. Comparative efficacy of different modes of exercise on inflammatory markers in patients with chronic kidney disease: a systematic review with pairwise and network meta-analyses. *Sci Rep*. 2026;16(1):17312. doi:10.1038/s41598-026-45519-9

19. Marrone G, Murri A, Urciuoli S, et al. Functional Foods and Adapted Physical Activity as New Adjuvant Therapy for Chronic Kidney Disease Patients. *Nutrients*. 2024;16(14):2325. doi:10.3390/nu16142325

20. Murri A, di Lauro M, Grazioli E, et al. Is Adapted Physical Exercise an Innovative Adjuvant Approach to Combine with Low-Protein Diet in Chronic Kidney Disease? *Nutrients*. 2026;18(10):1557. doi:10.3390/nu18101557

21. Noce A, Tranchita E, Marrone G, et al. The possible role of physical activity in the modulation of gut microbiota in chronic kidney disease and its impact on cardiovascular risk: a narrative review. *Eur Rev Med Pharmacol Sci*. 2023;27(8):3733-3746. doi:10.26355/eurrev_202304_32172

22. Noor H, Reid J, Slee A. Resistance exercise and nutritional interventions for augmenting sarcopenia outcomes in chronic kidney disease: a narrative review. *J Cachexia Sarcopenia Muscle*. 2021;12(6):1621-1640. doi:10.1002/jcsm.12791

23. Srivastava P, Singh SK, Nair RS, et al. Resistance-based exercise restores muscle health in dialysis patients. *J Muscle Res Cell Motil*. 2026;47(1):8. doi:10.1007/s10974-026-09727-0

24. Zeng G, Lin Y, Xie P, Lin J, He Y, Wei J. Association between physical activity & sedentary time on frailty in adults with chronic kidney disease: Cross-sectional NHANES study. *Exp Gerontol*. 2024;195:112557. doi:10.1016/j.exger.2024.112557

25. Li J, Li Y, Shi W, Guo Q, Yang Q, Chu Z. Effects of exercise training on depression, anxiety, and physical health-related quality of life in end-stage renal disease patients receiving maintenance hemodialysis: a systematic review and meta-analysis of randomized controlled trials. *Front Public Health*. 2026;14. doi:10.3389/fpubh.2026.1788845

26. Zou ZH, Zhang JQ, Yi ZH, Chen X, Qing W. Effects of intradialytic exercise on frailty in maintenance hemodialysis patients: a systematic review and meta-analysis. *Front Physiol*. 2025;16. doi:10.3389/fphys.2025.1600219

27. Verrelli D, Sharma A, Alexiuk J, et al. Effect of Intradialytic Exercise on Cardiovascular Outcomes in Maintenance Hemodialysis: A Systematic Review and Meta-Analysis. *Kidney360*. 2024;5(3):390-413. doi:10.34067/KID.0000000000000361

28. Lee CL, Wang PC, Chen YL, et al. Comparisons of Intradialytic Exercise Versus Home-Based Exercise in Hemodialysis Patients: A Narrative Review. *Biomedicines*. 2024;12(10):2364. doi:10.3390/biomedicines12102364