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Review

Yoga for Promoting Physical and Mental Health in Patients with Chronic Kidney Disease: A Systematic Review

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Abstract

Chronic kidney disease (CKD) is a growing global public health burden with significant physical and mental health challenges. This study aimed to systematically review the available evidence on the effects of yoga interventions on improving the physical and mental health of patients with CKD. The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines were followed. The systematic search was conducted in January 2023 using Scopus and PubMed, resulting in 99 documents, of which 9 met the selection criteria. The studies explored the effects of different types of yoga interventions on various health aspects in hemodialysis and CKD patients. The durations ranged from 15 days to 6 months. The types of yoga used varied, including Hatha Yoga, Pranayama, and yoga therapy. Outcome measures included dialysis adequacy, fatigue, insomnia, lipid profile, oxidative stress, renal function, blood pressure, and quality of life. The findings demonstrate the feasibility of the yoga intervention and the positive effects of the intervention on health outcomes, such as improved dialysis adequacy, reduced fatigue and insomnia, better lipid profiles, decreased oxidative stress, enhanced renal function, lowered blood pressure, and improved quality of life. Yoga interventions show promise as a complementary approach for managing CKD. The positive effects observed on multiple health outcomes suggest the potential benefits of incorporating yoga into CKD care. However, further well-designed trials are needed to strengthen the evidence base. Healthcare providers should consider including yoga as part of a comprehensive approach to improve the well-being of CKD patients.

Keywords: Health; Yoga; Hemodialysis; Intradialytic; Chronic kidney patients

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Introduction

Chronic kidney disease (CKD), a condition characterized by the gradual decline of kidney function, is a growing global public health burden affecting millions worldwide, with an increased prevalence of 29.3% between 1990 and 2017 [1]. Kidney function decline in CKD is associated with various comorbidities and complications, including cardiovascular disease, anaemia, bone disorders, and mental health issues. In 2017, cardiovascular disease associated with CKD accounted for 1.3 million deaths and 35.8 million disability-adjusted life years (DALYs) [2]. The management and treatment of CKD also impose substantial costs on healthcare systems associated with dialysis, medications, hospitalizations, and long-term care. Therefore, addressing and mitigating CKD through preventive measures and interventions are significant public health priorities.

Extensive research has shown that exercise plays a significant role in managing CKD. Studies have consistently demonstrated positive effects of exercise on various parameters, including physical fitness, functional capacity, cardiovascular health, nutrition, lipid profiles, glucose metabolism, systemic inflammation, muscle morphology, and mortality rates) [3]. Specifically, regular exercise training has been associated with improved aerobic capacity, muscular functioning, cardiovascular function, walking capacity, and health-related quality of life in dialysis patients [4]. Moreover, exercise has been found to reduce cardiovascular risk, inflammation, cachexia, and hypertension; while increasing physical functioning, strength, and cardio-respiratory capacity in CKD patients [5]. Recent evidence also supports the effectiveness of home-based exercise programs in improving health-related quality of life and functional capacity and reducing symptoms of depression in CKD patients [4]. These findings emphasize the importance of exercise as a valuable adjunctive therapy in managing CKD, offering numerous health benefits and enhancing overall well-being for individuals with this condition. However, additional research is warranted to explore the type of exercise suitable for CKD populations.

While exercise can benefit individuals with CKD, there are several issues associated with exercise interventions in this population, including reduced exercise tolerance and comorbidities impacting exercise capacity. In this regard, yoga may benefit patients with low exercise tolerance. Multiple studies have shown the positive effects of yoga on various health conditions that may also experience low exercise tolerance. Studies suggest that Yoga improves lipid profiles [6] and reduces waist circumference and systolic blood pressure [7], among metabolic syndrome patients. Yoga also reduces diastolic blood pressure and triglycerides and improves high-density lipoprotein (HDL) cholesterol levels; thus, it is effective in the primary prevention of cardiovascular disease [8] as well as improvement of glycemic and renal parameters among diabetic patients [9]. Yoga also has shown positive outcomes in quality of life, pain, fatigue, sleep disturbance, physical function, and biochemical variables among chronic hemodialysis patients [3], beneficial impact on nephrotic disorders [3,10] and a positive effect to blood pressure, oxidative stress, and inflammatory conditions among patient with CKD [11]. Furthermore, yoga along with other complementary alternative medicines such as herbal medicine, acupuncture, and aromatherapy may alleviate symptoms in kidney disease patients, although should be approached with caution due to limitations and potential risks that might alleviate symptoms in patients with CKD [12].

Systematic reviews have been conducted to synthesize evidence of the roles of yoga in improving overall health outcomes in the general population [9,13], as well as in chronic conditions such as metabolic syndrome [14], cardiovascular disease [15] and cancer [16]. However, a systematic review of yoga intervention in CKD management is still lacking. Therefore, this study aimed to systematically review the effects of yoga on the physical and mental well-being of CKD patients. It is expected that the findings of this study will provide a comprehensive synthesis of the evidence and guide the future on the role of yoga in CKD management.

Methods

Study design and protocol

This systematic review is appropriate with Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA).

Sources and literature search

A systematic search was conducted in January 2023 to capture studies written in English and found in the PubMed and Scopus databases from inception until the date of the search. The search strategy is summarized in table 1.

Eligibility and study selection

The results of the study included if: (1) conducted in patients with chronic kidney disease (2) included yoga intervention, and (3) published as articles. Exclusion criteria included brief comments or letters written in non-IMRAD format (Introduction, Methods, Results, and Discussion) or published as a literature review, and if the full-text were not available

Figure 1 illustrates the search and screening process flow based on PRISMA. References generated

Table 1. Search strategy

Base data	Keywords
PubMed	(((yoga) OR ("sun salutation") OR ("hatha yoga"))) AND ((("chronic renal disease") OR ("renal failure") OR ("kidney disease") OR ("chronic kidney") OR ("chronic renal failure") OR ("renal disease")))
Scopus	((TITLE-ABS-KEY (yoga) OR TITLE-ABS-KEY ("sun salutation") OR TITLE-ABS-KEY ("hatha yoga"))) AND ((TITLE-ABS-KEY ("chronic renal disease") OR TITLE-ABS-KEY ("renal failure") OR TITLE-ABS-KEY ("kidney disease") OR TITLE-ABS-KEY ("chronic kidney") OR TITLE-ABS-KEY ("chronic renal failure") OR TITLE-ABS-KEY ("renal disease")))

from the search strategy are imported into reference management software (EndNote XX). All duplicates were removed automatically and manually and then filtered in three stages (title, abstract, and full-text), resulting in the selected studies included in this review.

Studies selection, quality assessment, and data extraction

The first author (RPA) performed initial searching from the databases, removed duplicates, and screened titles, abstracts, and full-texts. Discussions with 2nd and 3rd authors (YS and NIA) were conducted to finalize the selected studies' screening, quality assessment, and data extraction. The quality assessments were carried out using instruments for measuring the quality assessment of controlled intervention studies developed by the National Heart, Lung and Blood Institute (2013), which can be accessed at https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools. Following the quality assessment, the data extraction for each study included: (1) author name and year of publication, (2) research design, (4) objectives, (5) participants, (6) intervention allocation and duration, (7) outcome measures, and (6) results. The data extraction was completed using tables in Microsoft Excel (Microsoft Corporation, Redmond, WA, USA).

Results

Study selection and quality assessment

Following the screening procedures, nine studies were eligible for the systematic review and the quality of the selected studies was fair to good. The complete assessment of the quality of this study is available in table 2. Table 3 summarizes the data extracted from studies investigating the effects of various types of yoga interventions on the health of hemodialysis and CKD patients. These studies had different durations, ranging from 15 days [17] to 6 months [24]. The types of yoga interventions varied across the studies, ranging from a 15-day Pranayama breathing technique [17,26], a 12-week feasibility study on intradialytic yoga [18,23], a feasibility study of a 4-month Intradialytic Yoga Program [22], a four months Hatha Yoga program [24], a 6-month program Yoga therapy [21,22], and a 3-month modified yoga-based exercise program [24]. The outcome measures in these studies encompassed a wide range of parameters, including measures of feasibility [18], adherence [24], safety [25,21], fatigue and insomnia, oxidative stress, renal function, blood pressure, and quality of life [24]; while another study assessed pain intensity, sleep disturbance, grip strength, and various biochemical markers such as urea, creatinine, calcium, alkaline phosphatase, phosphorus, cholesterol, and HDL cholesterol [17]. These studies demonstrated that different types of yoga interventions practiced for varying durations were feasible and positively affected multiple health outcomes in hemodialysis and CKD patients.

Discussion

While previous research has reviewed the roles of exercise in managing CKD [26], or the effect of yoga in managing other chronic diseases such as diabetes mellitus [28] and cardiovascular diseases [29], this systematic review is the first study that synthesizes the available evidence on the potential effects of yoga interventions on the physical and mental health of CKD patients. The findings from this systematic review indicated various yoga interventions were feasible [29,30,31] in improving various health aspects in CKD patients. Each study examined the effects of yoga interventions over specific durations, ranging from 15 days [17] to 6 months [33]. The types of yoga used included hatha yoga [30], pranayama [33,23], intradialytic yoga [4], and yoga therapy [35]. The findings signify the potential effects of both short-term and longer-term yoga practice for CKD patients and highlight the potential of different types of yoga used for CKD patients. However, while the literature suggests potential benefits of yoga, the diversity in outcome measures across studies poses challenges for interpreting findings on yoga interventions for CKD patients. This variability complicates direct comparisons and hinders the establishment of consistent evidence. The absence of standardized outcome measures impedes uniform evaluation criteria and makes it difficult to assess yoga's broader impact on specific aspects of CKD. The focus on diverse outcomes, such as fatigue, insomnia, lipid profiles, and quality of life,

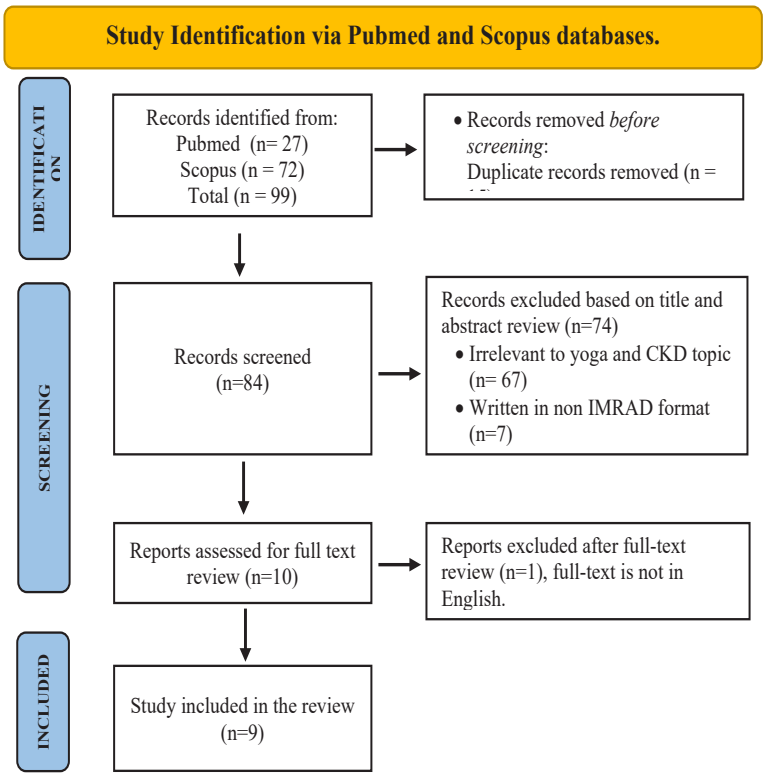

Figure 1. The study screening process

creates difficulties in cross-study comparisons. This diversity limits generalizability and makes deriving standardized clinical recommendations challenging for healthcare providers. Future research should adopt standardized outcome measures and prioritize patient-centered outcomes for a more comprehensive understanding, advancing the field, enhancing evidence quality, and supporting clear clinical recommendations.

The reviewed studies encompass a diverse spectrum of yoga interventions targeting individuals undergoing hemodialysis or CKD, with notable variations in study duration, types of yoga, and participant characteristics. Short-term interventions, such as the 15-day Pranayama program [17] were contrasted with medium-term approaches such as the three-month intervention [25] and the 12-week programs [18,20,23] and showcased the diversity in study durations. Furthermore, the types of yoga interventions varied, including breath-focused practices like Pranayama, intradialytic yoga, Hatha yoga, yoga therapy, and even laughter yoga [4]. Participant characteristics were also diverse, with studies focusing on hemodialysis patients [17,25], or CKD patients [20,24]. Key findings highlighted the feasibility and safety of intradialytic yoga, reductions in lipid parameters through yoga therapy, and improvements in oxidative stress indicators and antioxidant enzyme activities with Hatha yoga. The impact on quality of life and psychological outcomes varied across studies, and adherence was notably high in interventions such as intradialytic yoga. In essence, this comprehensive analysis underscores the multifaceted nature of yoga interventions and their potential benefits for individuals with CKD, thus suggesting that incorporating yoga interventions into the care of CKD patients may benefit their physical and mental well-being.

While yoga does not directly cure CKD, several mechanisms contribute to its potential improvement of the condition. Firstly, yoga reduces stress, which can impact kidney function and CKD progression [34,36], Secondly, it helps manage blood pressure, a common factor in CKD development and progression [23]. Yoga poses, breathing exercises, and meditation techniques improve cardiovascular health and may also aid in blood pressure control. Thirdly, certain yoga postures increase blood flow to the kidneys, potentially enhancing their function by facilitating waste removal [35]. Additionally, regular yoga practice improves flexibility, circulation, and muscle stiffness, which can be beneficial for CKD patients [37]. Finally, the mindfulness and meditation aspects of yoga promote self-awareness, allowing individuals to better monitor symptoms and make healthier lifestyle choices [35,34]. However, further research is needed to fully understand the precise pathways through which yoga generates improvements among CKD patients. The proposed multifaceted mechanisms of stress reduction, anti-inflammatory effects, and cardiovascular benefits in

Table 2. The quality assessment of the selected studies

	Bhuvaneswari, 2020 [17]	Birdee, 2015 [18]	Bennett, 2015 [19]	Dutta, 2018 [20]	Gordon, 2012 [21]	Gordon, 2013 [22]	Herron , 2022[23]	Rajendra, 2017 [24]	Yurtkuran, 2007 [25]
1. Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT?	Y	Y	N	N	Y	Y	Y	Y	Y
2. Was the method of randomization adequate (i.e., use of randomly generated assignment)?	Y	Y	N	N	Y	Y	Y	Y	Y
3. Was the treatment allocation concealed (so that assignments could not be predicted)?	N	N	N	N	N	N	N	N	N
4. Were study participants and providers blinded to treatment group assignment?	N	N	N	N	N	N	N	Y	N
5. Were the people assessing the outcomes blinded to the participants' group assignments?	N	N	N	Y	Y	Y	Y	Y	Y
6. Were the groups similar at baseline on important characteristics that could affect outcomes (e.g., demographics, risk factors, co-morbid conditions)?	Y	Y	Y	N	Y	Y	Y	Y	Y
7. Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment?	N	N	N	N	N	N	N	N	N
8. Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower?	N	N	N	N	N	N	N	N	N
9. Was there high adherence to the intervention protocols for each treatment group?	Y	Y	Y	Y	Y	Y	Y	Y	Y
10. Were other interventions avoided or similar in the groups (e.g., similar background treatments)?	N	N	N	N	N	N	Y	Y	N
11. Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants?	Y	Y	Y	Y	Y	Y	Y	Y	Y
12. Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?	Y	Y	Y	N	Y	Y	N	N	Y
13. Were outcomes reported or subgroups analyzed prespecified (i.e., identified before analyses were conducted)?	Y	Y	Y	Y	Y	Y	Y	Y	Y
14. Were all randomized participants analyzed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis?	Y	Y	Y	N	Y	Y	Y	Y	Y
Conclusion	G	G	F	F	G	G	G	G	G

Note: G= Good, F = Fair, P=Poor

Yoga potentially address key factors in CKD, including hypertension [38,39]. Additionally, yoga supports immune function, modulates the autonomic nervous system, and promotes kidney health through fluid and electrolyte balance [24,31]. Its positive impact on mental health indirectly contributes to better outcomes in CKD. Encouraging a holistic approach with mindful eating and physical activity, yoga promotes a healthy lifestyle for CKD management [39]. Understanding these concise mechanisms enriches our comprehension of yoga's therapeutic effects, guiding future research for positive changes in kidney health [34].

The systematic review followed the PRISMA guidelines, ensuring a rigorous and transparent approach to the literature search and selection process. The review included studies with diverse types of yoga interventions and outcome measures, providing a comprehensive overview of the available evidence. The positive effects observed across multiple health outcomes indicate the potential efficacy of yoga interventions for CKD patients. However, there are several limitations to consider. The synthesis of existing research on yoga interventions for individuals with CKD reveals significant variability in study durations, types of yoga interventions, and outcome measures, posing challenges for direct comparisons and limiting the feasibility of conducting a meta-analysis. The observed heterogeneity emphasizes the need for caution in drawing overarching

Table 3. Data extraction

	Authors	Design	Objectives	Partic-ipants/ Duration	Intervention & duration	Outcomes measures	Main findings
1	Bhu-vaneswari, 2020 [17]	One group pretest and post-test design	Assess the effectiveness of Pran-ayama on fatigue and insomnia	60 hemo-dialysis patients	Pranayama 15 minutes twice a day, one hour after hemodi-alysis 15 days	Fatigue Insomnia	• Pranayama was effective in reducing fatigue and insomnia • The mean difference pre and post-test of fatigue and insomnia were 40.29 and 10.38, respectively (p= 0.0001)
2	Birdee, 2015 [18]	RCT	Assess the feasibility and safety of an intradi-alytic yoga intervention	31 hemo-dialysis patients	Intradialytic yoga inter-vention (n-18) vs. a kidney education in-tervention (n=13) 12 weeks	Feasibility, Adherence Safety	• Intradialytic yoga was feasible and safe in maintenance hemodi-alysis patients. • Participants in the intradialytic yoga group practiced yoga for a median of 21 sessions (70% participation frequency). • Participants in the educational program completed a median of 30 sessions (83% participation frequency).
3	Bennett, 2015 [19]	One group pretest and posttest design	Assess the feasibility of conducting Intradialytic Yoga and examine its effects on psycho-logical and physiologi-cal, as well as calculate the required sample size for future study	18 hemo-dialysis patients	Intradialytic yoga (Laughter yoga) pro-gram (30-min inter-vention three times per week) Four months.	Quality of life Mood Optimism Control Self-esteem De-pression, Anxiety Stress. Blood pressure, Intradialytic hypo-tensive Forced expiratory volume	• There was 94 % retention rate of the program. • There were non-significant increases in happiness, mood, and optimism and a decrease in stress. • Episodes of intradialytic hypotension decreased from 19 pre and 19 during Laughter Yoga to 4 post-Laughter Yoga. • There was no change in lung function or blood pressure. • Sample size calculations for future research indicated that a minimum of 207 participants would be required to provide suffi-cient power to detect change in key psychological variables. • This study provides evidence that Laughter Yoga is a safe, low-intensity form of intradialytic physical activity that can be successfully implemented for patients in dialysis settings. How-ever, more extensive studies are required to determine the effect of Laughter Yoga on key psychological variables.

4	Dutta, 2018 [20]	RCT	Assess the effect of yoga therapy on fasting lipid profile	60 CKD patients	Yoga therapy (10 to 12 supervised sessions with home practice diary and telephonic follow-up) (n=30) vs. Control (n=30) Three months	Triglycerides, Low-density Lipoprotein (LDL) High-density Lipoprotein (HDL)- Total cholesterol	• Triglycerides, LDL, and VLDL decreased in the yoga group. • Total cholesterol decreased, and HDL increased but not statistically significant.
5	Gordon, 2012 [21]	RCT	Assess the effect of Hatha yoga on lipid parameters and cholesterol.	68 hemodialysis patients	Hatha yoga exercise (30 minutes of supervised and additional unsupervised home training) (n=33) vs. Control (n=35) Four months	Triglycerides, Low-density Lipoprotein (LDL) High-density Lipoprotein (HDL)- Total cholesterol	• Hatha yoga exercise significantly decreased total cholesterol, triglycerides, LDL-cholesterol, and total cholesterol/HDL-cholesterol ratio in ESRD patients. • After four months of Hatha yoga exercise, 70.0% of patients had normal total cholesterol, and 84.9% had normal LDL cholesterol.
6	Gordon, 2013 [22]	RCT	Assess the effect of Hatha yoga on oxidative stress indicators and oxidant status	68 hemodialysis patients	Hatha yoga exercise (30 minutes of supervised and additional unsupervised home training) (n=33) vs. Control (n=35) Four months	Malondialdehyde Protein oxidation Phospholipase Superoxide dismutase Catalase	• Hatha yoga exercise significantly reduced lipid peroxidation, protein oxidation, and phospholipase A2 activity • Superoxide dismutase and catalase activities significantly increased after four months of yoga exercise. • There was a significant correlation between pre-hemodialysis oxidative stress parameters at the zero month and after four months.

7	Herron, 2022 [23]	RCT	Assess the feasibility of Intradialytic intervention on quality of life, self-efficacy, and physical performance.	67 hemodialysis patients	Intradialytic Yoga (n=34) vs. Control (n=33) 12 weeks	Quality of life 6-minute walking time Mental health	• There were no significant changes in physical function by patient-reported (kidney disease quality of life) or performance measures (6-minute walk tests) for either treatment arm. • From baseline to 6 weeks, mental health had a statistically nonsignificant improvement among the IDY group and decreased in the education group. • At 12 weeks, mental health remained numerically higher in the yoga group than in the education group. • In an adjusted analysis considering baseline values, gender, and diabetes, the yoga group had nonsignificant improvements in mental health versus the education group. The estimated treatment effect was -9.21, with a 95% confidence interval ranging from -20.29 to 1.86. • No differences were observed over the study period regarding self-efficacy.
8	Pandey, 2017 [24]	RCT	Assess the effect of the yoga program on health parameters	54 CKD (50 completed the study)	Yoga therapy (5 days a week for 40-60 min a day of physical asana, pranayama, and relaxation) (n=25) vs. Control (n=25) 6 months	Systolic Diastolic Urea Creatinine Quality of life Number of dialysis	• A six-month yoga program is safe and effective as an adjuvant therapy in improving renal functions and QOL of CKD patients. • The yoga group showed a significant reduction of systolic and diastolic blood pressure, a significant reduction in blood urea and serum creatinine levels, and significant improvement in the physical and psychological domain of the World Health Organization QOL (as assessed by BREF QOL scores). • Poststudy comparison between the two groups showed a statistically significant reduction of blood pressure, a non-significant decrease in blood urea and serum creatinine, and considerable improvement in the physical and psychological domain of QOL in the yoga group compared to the control group.
9	Yurtkuran, 2007 [25]	RCT	Assess the effect of a yoga-based exercise program on pain, fatigue, sleep disturbance, and biochemical markers	37 hemodialysis patients	A modified yoga-based exercise program 30 min/day twice a week (n=19) vs. Control (n=18) 3 months	Pain Fatigue Sleep Grip strength Urea Creatinine Calcium Alkaline phosphatase Phosphorus Cholesterol HDL	• A modified yoga-based exercise program was safe and effective in hemodialysis patients, significantly improving pain, fatigue, sleep disturbance, grip strength, urea, creatinine, alkaline phosphatase, cholesterol, erythrocyte, and hematocrit count. • Improvement of the variables in the yoga-based exercise program was superior to that in the control group for all the variables except calcium, phosphorus, HDL-cholesterol, and triglyceride levels. • No side effects were seen.

conclusions. Additionally, variations in the quality and methodological rigor of included studies may influence the strength of the evidence, highlighting the importance of interpreting findings with consideration to study-specific contexts. To advance the field and provide more robust evidence, future research should address these limitations by conducting larger randomized controlled trials with standardized protocols. Such an approach would enhance comparability and strengthen the overall evidence base. Exploring the long-term effects of yoga interventions on critical outcomes, such as cardiovascular health, kidney function progression, and mortality in CKD patients, is essential for gaining valuable insights into the sustained impact of yoga on health outcomes. Investigating the underlying mechanisms of yoga's beneficial effects, particularly its impact on stress reduction, inflammation, and immune function, would contribute to a more comprehensive understanding of its therapeutic potential in CKD patients. Lastly, assessing the cost-effectiveness of integrating yoga interventions into CKD care is crucial for informing healthcare policy and resource allocation decisions, providing a holistic perspective on the feasibility and practicality of incorporating yoga as an adjunct therapy in the management of chronic kidney disease. Addressing these considerations in future research endeavors will significantly contribute to advancing our understanding of the potential benefits and optimal implementation of yoga interventions in the context of CKD care.

Conclusion

In conclusion, this systematic review has indicated that the available evidence suggests that yoga interventions can provide beneficial effects for patients with CKD. Different types of short-term and long-term yoga interventions, such as Hatha Yoga, Pranayama, and yoga asanas, have shown promising outcomes in improving dialysis adequacy, fatigue, insomnia, lipid profiles, oxidative stress, renal function, blood pressure, and quality of life in CKD patients. However, the review acknowledges the limitations of the existing evidence, including small study sizes and variations in design, interventions, and outcome measures. Further well-designed randomized controlled trials with larger sample sizes are needed to strengthen the evidence base and provide definitive conclusions. Future research should use standardized outcome measures and prioritize patient-centered outcomes to advance the field, improve evidence quality, and inform clear clinical recommendations. Studies to explore precise therapeutic yoga mechanisms in CKD care are also recommended. Nevertheless, based on current findings, healthcare providers should consider yoga as adjunctive therapy while ongoing research continues to refine clinical recommendations.

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Conflict of Interests

No conflict of interest was declared.

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