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Impact On Evidence-Based Clinical Practice of Considering Therapeutic Interventions in Patients with Chronic Kidney Disease

Disha Khatri *[1], Dhaval Patel [2].

[*1] MPT Scholar, Ahmedabad Physiotherapy College, Parul University, Gujarat, India.
[2] Assistant professor, Ahmedabad Physiotherapy College, Parul University, Gujarat, India.

Corresponding Author: Dr. Disha Khatri, MPT Scholar, Ahmedabad Physiotherapy College, Parul University, Gujarat, India. **E-Mail:** dishii.0101@gmail.com

ABSTRACT:

Background: Chronic kidney disease (CKD) is a progressive condition that may negatively affect musculoskeletal health. Patients with chronic kidney disease may experience better health outcomes when they engage in physical exercise.
Objective: This literature study aims to provide a better understanding about the pathophysiology of chronic kidney disease and role of therapeutic intervention and its implication in patients with CKD and to evaluate the best treatment strategies for chronic kidney disease.
Method: Relevant keywords will be used for the research through the electronic database PubMed, Medline, and Google scholar from January 2016 till January 2023. An open-source reference management software Zotero was used to manage bibliographic data and related research materials.
Result: Databases such as PubMed, Medline, Google scholar in which 10 articles where initially screened and meet the inclusion criteria. In PUBMED, GOOGLE SCHOLAR, MEDLINE 56,214 citations were screened from January 2015 to January 2023. After applied inclusion/ exclusion criteria such as an abstract screen, full text screen, and during data extraction 56,204 articles were excluded.
Conclusion: This review highlights the wide range of approaches used in clinical practice to evaluate physical performance and activity. Enhancing symptom management is critically needed to improve quality of life in advanced chronic kidney disease (CKD), even if minimizing mortality is still an important objective for kidney disease.
KEYWORDS: chronic kidney disease, prevalence of CKD, Physiotherapy treatment strategies.

BACKGROUND

Chronic kidney disease (CKD) is defined as the presence of kidney damage or an estimated glomerular filtration rate (eGFR) less than 60 ml/min/1.73 mt2, persisting for 3 months or more, irrespective of the cause. It is a state of progressive loss of kidney function, ultimately resulting in the need for renal replacement therapy (dialysis or transplantation).

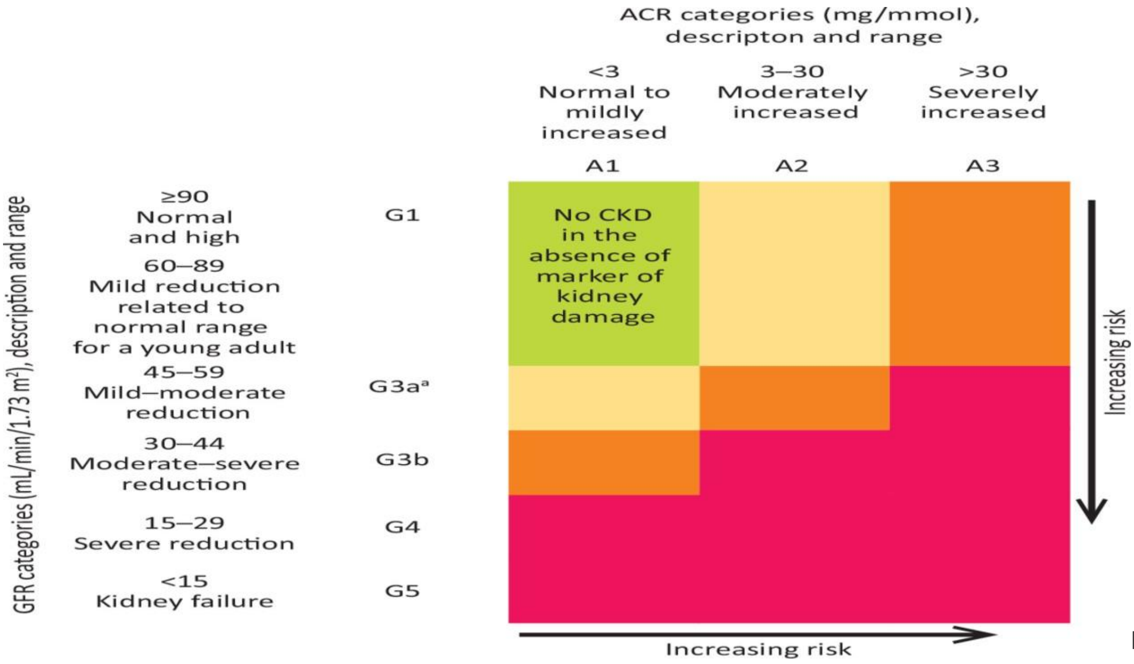
Kidney damage refers to pathologic abnormalities either suggested by imaging studies or renal biopsy, abnormalities in urinary sediment, or increased urinary albumin excretion rates. The 2012 KDIGO CKD classification recommends details about the cause of the CKD and classifies it into 6 categories based on glomerular filtration rate (G1 to G5 with G3 split into

3a and 3b). It also includes the staging based on three levels of albuminuria (A1, A2, and A3), with each stage of CKD being sub-categorized according to the urinary albumin-creatinine ratio in (mg/gm) or (mg/mmol) in an early morning “spot” urine sample [1].

The 6 categories include:

G1: GFR 90 ml/min per 1.73 m2 and above
G2: GFR 60 to 89 ml/min per 1.73 m2
G3a: GFR 45 to 59 ml/min per 1.73 m2
G3b: GFR 30 to 44 ml/min per 1.73 m2
G4: GFR 15 to 29 ml/min per 1.73 m2
G5: GFR less than 15 ml/min per 1.73 m2 or treatment by dialysis

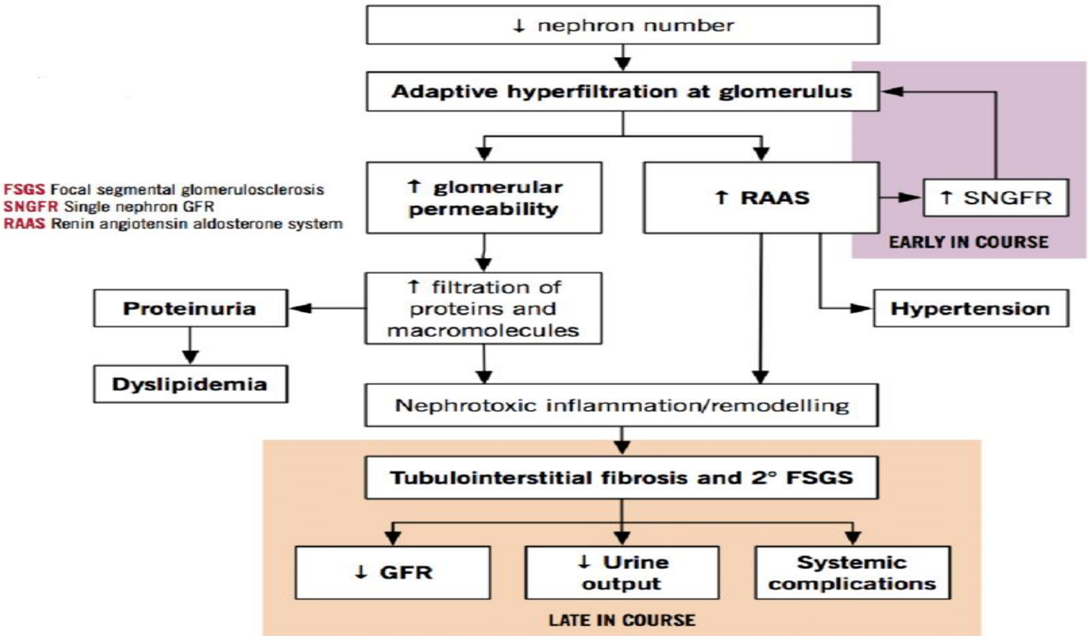
The three levels of albuminuria include an albumin-creatinine ratio (ACR)
A1: ACR less than 30 mg/gm (less than 3.4 mg/mmol)
A2: ACR 30 to 299 mg/gm (3.4 to 34 mg/mmol)
A3: ACR greater than 300 mg/gm (greater than 34 mg/mmol) [1].



[2]

Chronic kidney disease represents an especially large burden in low- and middle-income countries, which are least equipped to deal with its consequences [2,3].

The reported prevalence of CKD in different regions ranges from <1% to 13%, and recently, data from the International Society of Nephrology’s Kidney Disease Data Centre Study reported a prevalence of 17%. The aetiology of CKD varies considerably throughout India [4]. Progression of chronic kidney disease (CKD) involves the recruitment and engagement of cellular processes originating in specific compartments of the kidney on the one hand and biochemical pathways of cell injury that contribute to these processes on the other hand [5].



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Physical inactivity and a lack of regular exercise remain as key modifiable risk factors for general morbidity. Moreover, the need for health care practitioners to provide a formal exercise prescription to people with chronic disease has been recognized by multiple stakeholders [7]. Accordingly, physiotherapy programs have been proposed that aim not only to treat the clinical manifestations of the disease but also the adverse effects on cardiorespiratory and muscular function, the quality of life, would be enhanced by improving metabolic, physiological, and psychological conditions [8]. Physical exercise (PE) significantly benefits patients with chronic kidney disease (CKD).

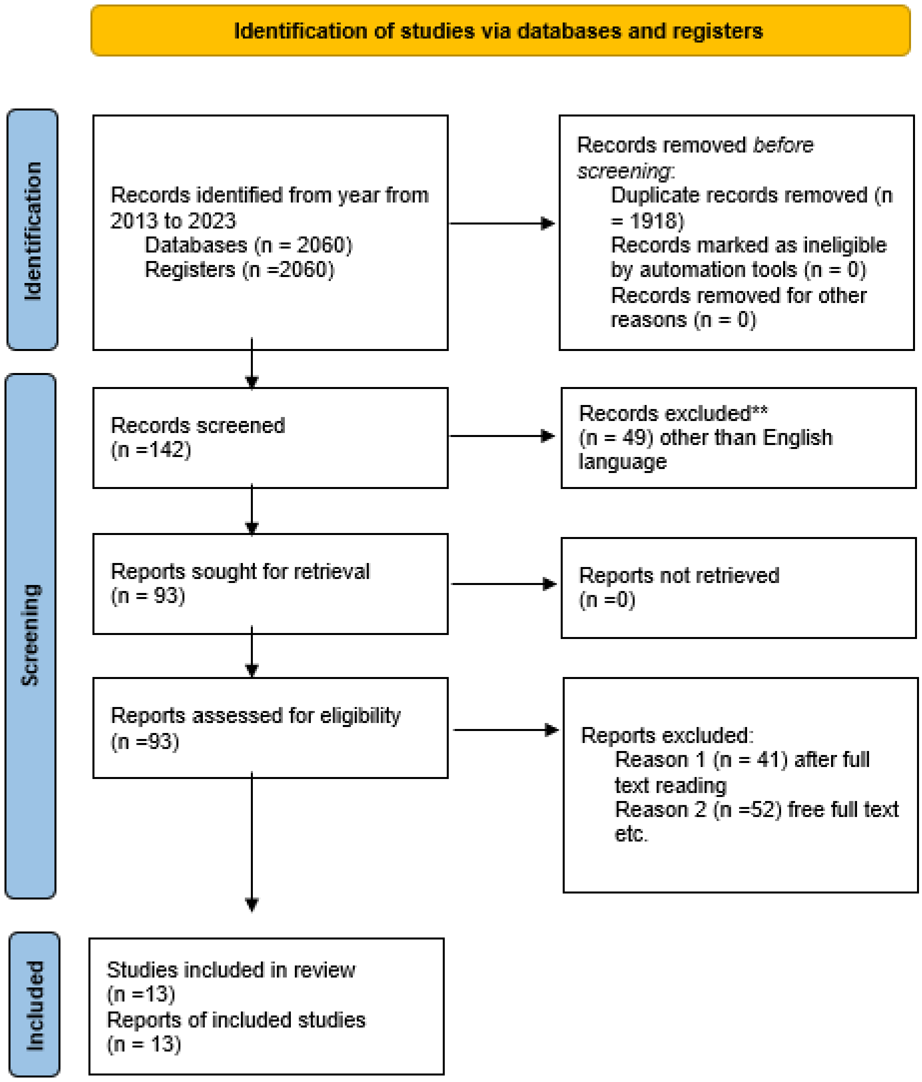
High-intensity interval training (HIIT) increases mitochondrial biogenesis and cardiorespiratory fitness in chronic disease populations, however has not been studied in people with chronic kidney disease (CKD). The aim of this study was to compare the feasibility, safety, and efficacy of HIIT with moderate-intensity continuous training (MICT) in people with CKD [9 ,10, 11]. Regular aerobic exercise has a significant effect on the estimated glomerular filtration rate, serum creatinine, 24-h urine protein amount, and blood urea nitrogen in CKD patients. Aerobic exercise with a single exercise duration longer than 30 min has a more significant effect on the estimated glomerular filtration rate, and aerobic exercise by walking or running can more effectively improve the serum creatinine in CKD patients.[12] Exercise professionals still need to understand CKD and work closely with their client's physician(s) during training to ensure their safety.

The benefits of resistance training (RT) for CKD patients include increased muscle mass by hypertrophy of type I and II muscle fibres, reductions in intramuscular lipids (fat), improvements in muscle metabolism, increased strength and functional capacity, and reductions in proinflammatory cytokines, such as C-reactive protein. Despite the use of low-protein diets as a management tool in patients with CKD, interventions that use RT contribute to all these benefits [13,14,15]. The neuromuscular electrical stimulation (NMES) is used on patients suffering from chronic obstructive pulmonary disease and heart failure. The results are promising, showing improvement in functional capacity of these patients. As patients suffering from CKD [16].

Need of the Review: Considering the roles that exercise plays in health, the purpose of this study is to look at the viability and possible advantages of various forms of exercise for individuals with chronic kidney disease. Because kidney disorders differ from one another, it is clinically relevant to investigate how different forms of exercise affect physical function and many aspects of health in patients.

METHOD AND MATERIALS

Relevant keywords will be used for the search through the electronic database PubMed, Medline, and Google scholar from January 2013 till January 2023. An open-source reference management software Zotero was used to manage bibliographic data and related research materials.



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

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RESULT

Evidence was reviewed and analysis was done based on Pedro's score and CEBM's Level of Evidence Scale. In the screening process, 2060 studies with potential relevance were initially identified. According to the eligibility criteria 13 articles are included in this study.

From 13 articles nine articles were RCTs and three were experimental studies and one was comparative study.

According to the results of four investigations, patients with CKD present poor physical conditioning, low muscular strength, and low tolerance to exercise. Neuromuscular Electrical Stimulation (NMES) was improving quadriceps muscle strength and the functional capacity of patients with CKD.

Two studies investigated different exercise training application techniques. One study reported that high intensity interval training and neuromuscular electrical stimulation techniques exhibited comparable effectiveness, while other studies indicated that the resistance training programme was more effective than high intensity interval training.

DISCUSSION

A review of the literature on clinical research design was done qualitatively. We found that 13 trials evaluating the use of resistance training, high-intensity interval training, aerobic exercise, and neuromuscular electrical stimulation to treat chronic kidney disease lacking key methodological components. The population characteristics, study design, primary outcomes, and interventions were among these components.

Exercise causes a small decrease in renal blood flow, but normal renal function is maintained when the filtration fraction adjusts. While the exact method by which physical activity, or exercise, may prevent or even aid in the healing process after chronic kidney disease (CKD) in humans is yet unknown, one mechanism that may be important is the well-known anti-inflammatory effect of physical activity [15].

Exercise is well known to have potent anti-inflammatory effects. The mechanisms underlying these effects include: the release of interleukin-6 (IL-6) from contracting skeletal muscle, which increases levels of anti-inflammatory cytokines; the reduction of proinflammatory cytokine production secondary to the reduced expression of toll-like receptors on monocytes and macrophages; and the reduction of visceral fat, which decreases secretion of pro-inflammatory adipokines [15].

The possible benefits of aerobic and resistance exercise in individuals with severe chronic renal disease were examined in research by Kiyotaka Uchiyama et al (CKD). During a six-month period, patients engaged in aerobic exercise at 40–60% of their peak heart rate three times a week and resistance training at 70% of their one-repetition maximum twice a week at home. The results showed that the home-based exercise programme enhanced patients' HRQOL and aerobic capacity in Stage 4 CKD patients, and it may also have positive effects on kidney function and CKD-related parameters.

Thaís B de Araújo et. Al. conducted the study revelling that it was mandatory the development of supervised home-based Resistance Training (RT) protocols in patients with chronic kidney disease Results provide new evidence that supervised home-based progressive RT may be a relevant intervention to attenuate the progression of CKD and improve functional capacity, bone mineral density, and the immunometabolism profile. These improvements are associated with positive modulation of several exercises.

It has previously been reported that NMES can increase muscle strength in clinical settings. Because it can activate the same signalling pathways that are triggered by voluntary activity, NMES has been dubbed an "exercise mimic." Furthermore, NMES can replicate the effects of high-intensity exercise on the recruitment of "fast-twitch" muscle fibers since it causes synchronized recruitment of muscle fibers regardless of their contractile/metabolic profile. NMES enhances functional endurance and muscular oxidative capacity, particularly in clinical patient populations. It is now known that electrically evoked muscular contractions (NMES) cause the activation of corticomotor pathways, much like voluntary contractions do. This contradicts the long-held belief that NMES circumvents the central nervous system. As a result, NMES may encourage advantageous modifications in the central and peripheral nervous systems; studies have shown that this tactic enhances neuronal activity [16-26].

A study is carried out by PL Valenzuela et. Al. Does neuromuscular electrical stimulation (NMES) applied during hemodialysis sessions improve functional capacity in people with chronic renal disease concluded that NMES is safe, practical, and effective for improving functional capacity and muscle strength in chronic kidney patients [27-28].

CONCLUSION

In conclusion, this evidence-based study demonstrated the positive effects of different forms of exercise on chronic kidney diseases. Physical Exercise (aerobic and resistive exercise) along with neuromuscular electrical stimulation When it is all considered, there appear to be significant benefits for CKD patients, including better glomerular filtration, lowered cardiovascular risk factors, increased maximal oxygen uptake, enhanced muscle protein synthesis, increased or maintained strength, improved body composition, improved quality of life, and other health-related aspects.

REFERENCE

[1]. Vaidya SR, Aeddula NR. Chronic Kidney Disease. 2024 Jul 31. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. PMID: 30571025.
[2]. Forbes A, Gallagher H. Chronic kidney disease in adults: assessment and management. Clinical Medicine. 2020 Mar;20(2):128.
[3]. Kovesdy CP. Epidemiology of chronic kidney disease: an update 2022. Kidney International Supplements. 2022 Apr 1;12(1):7-11.

[4]. Varughese S, Abraham G. Chronic kidney disease in India: A clarion call for change. Clinical journal of the American Society of Nephrology: CJASN. 2018 May 5;13(5):802.
[5]. Patel DM, Bose M, Cooper ME. Glucose, and blood pressure-dependent pathways–the progression of diabetic kidney disease. International journal of molecular sciences. 2020 Mar 23;21(6):2218.
[6]. Agarwal A, Nath KA. Pathophysiology of chronic kidney disease progression: organ and cellular considerations. InChronic Renal Disease 2020 Jan 1 (pp. 263-278). Academic Press.
[7]. Arazi H, Mohabbat M, Saidie P, Falahati A, Suzuki K. Effects of different types of exercise on kidney diseases. Sports. 2022 Mar;10(3):42.
[8]. Hernandez HJ, Obamwonyi G, Harris-Love MO. Physical therapy considerations for chronic kidney disease and secondary sarcopenia. Journal of functional morphology and kinesiology. 2018 Jan 5;3(1):5.
[9]. Neto JR, e Castro LM, de Oliveira FS, Silva AM, Dos Reis LM, Quirino AP, Dragosavac D, Kosour C. Comparison between two physiotherapy protocols for patients with chronic kidney disease on dialysis. Journal of Physical Therapy Science. 2016;28(5):1644-50.
[10]. Villanego F, Arroyo D, Martínez-Majolero V, Hernández-Sánchez S, Esteve-Simó V. Importance of physical exercise prescription in patients with chronic kidney disease: results of the survey of the Grupo Español Multidisciplinar de Ejercicio Físico en el Enfermo Renal [Spanish Multidisciplinary Group of Physical Exercise in Kidney Patients](GEMEFER). Nefrología (English Edition). 2023 Mar 30.
[11]. Beetham KS, Howden EJ, Fassett RG, Petersen A, Trewin AJ, Isbel NM, Coombes JS. High-intensity interval training in chronic kidney disease: A randomized pilot study. Scandinavian Journal of Medicine & Science in Sports. 2019 Aug;29(8):1197-204.
[12]. Ma Q, Gao Y, Lu J, Liu X, Wang R, Shi Y, Liu J, Su H. The effect of regular aerobic exercise on renal function in patients with CKD: A systematic review and meta-analysis. Frontiers in Physiology. 2022 Sep 26;13:901164.
[13]. Ronai P, Sorace P. Resistance training for persons with chronic kidney disease. Strength & Conditioning Journal. 2008 Aug 1;30(4):28-30.
[14]. Schardong J, Stein C, Plentz RD. Neuromuscular electrical stimulation in chronic kidney failure: a systematic review and meta-analysis. Archives of Physical Medicine and Rehabilitation. 2020 Apr 1;101(4):700-11.
[15]. Arazi H, Mohabbat M, Saidie P, Falahati A, Suzuki K. Effects of different types of exercise on kidney diseases. Sports. 2022 Mar;10(3):42.
[16]. Uchiyama K, Adachi K, Muraoka K, Nakayama T, Oshida T, Yasuda M, Hishikawa A, Minakuchi H, Miyashita K, Tokuyama H, Wakino S. Home-based aerobic exercise and resistance training for severe chronic kidney disease: a randomized controlled trial. Journal of cachexia, sarcopenia and muscle. 2021 Dec;12(6):1789-802.
[17]. Kirkman DL, Ramick MG, Muth BJ, Stock JM, Townsend RR, Edwards DG. A randomized trial of aerobic exercise in chronic kidney disease: evidence for blunted cardiopulmonary adaptations. Annals of physical and rehabilitation medicine. 2021 Nov 1;64(6):101469.
[18]. Aryuyuen N, Tudpor K. Aerobic exercise program improves renal functions in patients with chronic kidney disease stages 1 and 2: a randomized controlled trial. Turk J Physiother Rehabil. 2021;32(3).

[19]. Watson EL, Viana JL, Wimbury D, Martin N, Greening NJ, Barratt J, Smith AC. The effect of resistance exercise on inflammatory and myogenic markers in patients with chronic kidney disease. Frontiers in physiology. 2017 Jul 28;8:541.
[20]. Watson EL, Gould DW, Wilkinson TJ, Xenophontos S, Clarke AL, Vogt BP, Viana JL, Smith AC. Twelve-week combined resistance and aerobic training confers greater benefits than aerobic training alone in nondialysis CKD. American Journal of Physiology-Renal Physiology. 2018 Jun 1;314(6):F1188-96.
[21]. de Araújo TB, de Luca Corrêa H, de Deus LA, Neves RV, Reis AL, Honorato FS, Barbosa JM, Palmeira TR, Aguiar SS, Sousa CV, Santos CA. The effects of home-based progressive resistance training in chronic kidney disease patients. Experimental Gerontology. 2023 Jan 1;171:112030.
[22]. Gadelha AB, Cesari M, Corrêa HL, Neves RV, Sousa CV, Deus LA, Souza MK, Reis AL, Moraes MR, Prestes J, Simões HG. Effects of pre-dialysis resistance training on sarcopenia, inflammatory profile, and anemia biomarkers in older community-dwelling patients with chronic kidney disease: a randomized controlled trial. International urology and nephrology. 2021 Oct 1:1-1.
[23]. Roxo RS, Xavier VB, Miorin LA, Magalhães AO, Sens YA, Alves VL. Impact of neuromuscular electrical stimulation on functional capacity of patients with chronic kidney disease on hemodialysis. Brazilian Journal of Nephrology. 2016 Jul;38:344-50.
[24]. Brüggemann AK, Mello CL, Dal Pont T, Kunzler DH, Martins DF, Bobinski F, Yamaguti WP, Paulin E. Effects of neuromuscular electrical stimulation during hemodialysis on peripheral muscle strength and exercise capacity: a randomized clinical trial. Archives of physical medicine and rehabilitation. 2017 May 1;98(5):822-31.
[25]. Moraes IG, Brito CP, de Souza Francisco D, Faria LM, Luders C, de Brito CM, Yamaguti WP. Protocol: Efficacy of neuromuscular electrical stimulation with combined low and high frequencies on body composition, peripheral muscle function and exercise tolerance in patients with chronic kidney disease undergoing haemodialysis: a protocol for a randomised, double-blind clinical trial. BMJ Open. 2022;12(11).
[26]. Schardong J, Stein C, Plentz RD. Neuromuscular electrical stimulation in chronic kidney failure: a systematic review and meta-analysis. Archives of Physical Medicine and Rehabilitation. 2020 Apr 1;101(4):700-11.
[27]. Beetham KS, Howden EJ, Fassett RG, Petersen A, Trewin AJ, Isbel NM, Coombes JS. High-intensity interval training in chronic kidney disease: A randomized pilot study. Scandinavian Journal of Medicine & Science in Sports. 2019 Aug;29(8):1197-204.
[28]. Beetham KS, Howden EJ, Fassett RG, Petersen A, Trewin AJ, Isbel NM, Coombes JS. High-intensity interval training in chronic kidney disease: A randomized pilot study. Scandinavian Journal of Medicine & Science in Sports. 2019 Aug;29(8):1197-204.

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