The Effect of Exercise During Dialysis on Key Indices of Sarcopenia in Elderly Patients with End-Stage Chronic Kidney Disease (ESRD)

Atika Anif Prameswari[1]

[1] Department of Nutrition and Health, Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia

Background

Recent clinical guidance recommends physical activity and exercise to improve physical function in elderly patients on dialysis.

Exercise has been shown to improve sarcopenia outcomes in stable dialysis patients, but there is no clear conclusion in elderly patients with ESRD. This study aimed to evaluate the effects of intradialytic exercise on sarcopenia in elderly patients with ESRD.

This review aimed to evaluate the effect of exercise training on outcomes related to sarcopenia including muscle strength, muscle quality, and physical performance in elderly patients receiving dialysis.

Methods

A systematic search for randomized controlled trials (RCTs)

- Databases: PubMed (MEDLINE), Cochrane Central Register of Controlled Trials (CENTRAL), and Scopus.
- Studies up until 12 January 2024 were identified from many databases.
- Keywords used as search terms were “chronic kidney disease”, “dialysis”, “exercise”, “physical function”.
- Study quality was assessed using the Physiotherapy Evidence Database (PEDro) Scale.

Table 1. PICOS for search strategy

Population	Intervention	Comparison	Outcomes
Elderly patients with end-stage chronic disease receiving dialysis	• Any physical exercise program. Physical exercise was intended as a regular weekly training program, irrespective of supervision, and duration of intensity. • Studies reporting a single exercise session to determine tolerance to physical effects were not considered for inclusion.	Usual care	Sarcopenia parameters (muscle mass, muscle strength, physical performance)

Methods

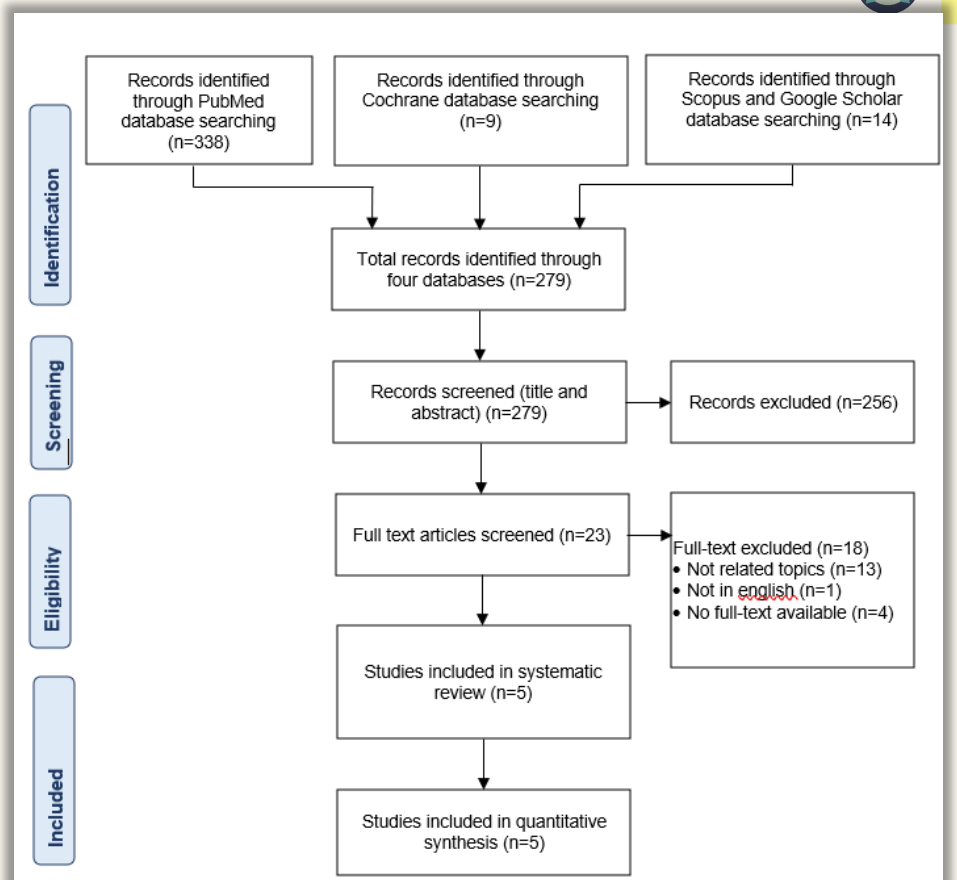

Figure 1. Flow diagram of systematic search

Results

Author (year), country	Participants	Intervention comparator	Outcomes measures	Duration	Results
Takahashi et al, 2022 (Ohio)	Total participant: n=308; 139 men, 169 women. Duration of dialysis=54.5±15 years.	Intervention: stretching exercise for 20 seconds; resistance training depending on the preference and ability of the participant, total duration 15 minutes per day	Physical function: hand grip strength, isometric knee extension strength, SPPB, 10MWT.	Follow-up: 12 months.	Physical performance • Isometric knee extension strength ⬆* • SPPB ⬆* • 10MWT ⬆*
Watanabe et al, 2021 (Japan)	Total participant: n=53; 41 men, 12 women. Duration of dialysis=5.05±3.51 years Intervention: n=26;20 men, 6 women. Age=66.19±13.05 years. Control: n=27; 21 men, 6 women. Age=64.00±12.95 years.	Intervention: walk for 20-30 minutes, 3-5 times/week. Resistance exercise for upper and lower body, 3 times per week, one set of 10-15 repetitions. Control: usual care.	Physical function: hand grip strength, 30-s chair-stand test, 6MWT.	Follow-up: 6 months	Muscle strength • Handgrip strength (kg) (NS) Physical performance • 6MWT (m) ⬆* (in patients with high adherence to aerobic exercise)
Liao et al, 2016 (Taiwan)	Total participant: n=40; 17 men, 23 women. Duration of dialysis=6.4±5.0 years Intervention: n=20;8 men, 12 women. Age=62±8 years. Control: n=20; 9 men, 11 women. Age=62±9 years.	Intervention: cycling ergometry, 3 times/week for 30 minutes at an intensity of 12-15 on Borg's RPE scale. Control: usual care.	Physical function: 6MWT.	Follow-up: 12 weeks.	Physical performance • 6MWT (m) ⬆*
Bennett et al, 2016 (Australia)	Total participants: n=171;107 men, 64 women. Duration of dialysis=3.6±2.1 years. Age=68.1±12.6 years. Intervention: 12Wk group: n=51;31 men, 20 women. 24Wk group: n=61;37 men, 24 women. 36Wk group: n=59;39 men, 20 women.	Intervention: progressive free-weight exercises (resistance bands) for upper and lower body, 3 times per week, 2 sets of 15-20 repetitions. Control: usual care.	Strength: 30s STS. Physical function: 8Ft-TUG, Four-Square Step Test. QOL: KD-QOL Index.	Follow-up: 12, 24, 36 weeks.	Physical performance • TUG (s) ⬇* Muscle strength • 30s STS (NS)
Groussard el at, 2015 (France)	Total participants: n=18; 12 men, 6 women Duration of dialysis=3.3±0.7 years. Intervention: n=10; 7 men, 3 women. Age=68.4±3.7 years. Control: n=8; 5 men, 3 women. Age=66.5±4.6 years.	Intervention: progressive cycle ergometry, 3 times weekly for 15-30 minutes at an intensity of 55-60% of the watts determined in an ergometer test for pedal frequency 50r/minute. Control: usual care.	Physical function: 6MWT, VO1peak Muscle mass: lean and fat mass X-ray absorptiometry.	Follow-up: 12 weeks	Physical performance • 6MWT (m) ⬆*

Results

- Out of 279 screened, 5 papers were included
- The median duration of intervention was 12 weeks
- Sample size renged from n=18[5] to n=308[1]
- Three studies were good quality and the two other was of fair quality
- Muscle strength was assessed using 30s STS and handgrip strength
- Physical function was assessed using TUG, 6MWT, 10MWT

Conclusion

- This review showed that resistance training may lead to improvement in muscle strength and muscle mass of elderly patients during dialysis.
- There is still limited evidence of exercise intervention in dialysis. Larger and high-quality trials are needed to fully elucidate the efficacy of exercise on improving patients' physical function and sarcopenia related outcomes.

References

1. Takahashi R, Yabe H, Hibino T, Yamaguchi T, Morishita S, Kono K, et al. Influence of Malnutrition on the Improvement of Physical Function by Intradialytic Resistance Exercise in Patients Undergoing Hemodialysis. J Ren Nutr [Internet]. 2023;33(2):346–54. Available from: https://doi.org/10.1053/j.jrn.2022.09.005

2. Watanabe K, Kamijo Y, Yanagi M, Ishibashi Y, Harada T, Kohzuki M. Home-based exercise and bone mineral density in peritoneal dialysis patients: a randomized pilot study. BMC Nephrol. 2021;22(1):1–9.

3. Liao MT, Liu WC, Lin FH, Huang CF, Chen SY, Liu CC, et al. Intradialytic aerobic cycling exercise alleviates inflammation and improves endothelial progenitor cell count and bone density in hemodialysis patients. Med (United States). 2016;95(27).

4. Bennett PN, Fraser S, Barnard R, Haines T, Ockerby C, Street M, et al. Effects of an intradialytic resistance training programme on physical function: A prospective stepped-wedge randomized controlled trial. Nephrol Dial Transplant. 2016;31(8):1302–9.

5. Groussard C, Rouchon-Isnard M, Coutard C, Romain F, Malardé L, Lemoine-Morel S, et al. Beneficial effects of an intradialytic cycling training program in patients with end-stage kidney disease. Appl Physiol Nutr Metab. 2015;40(6):550–6.

6. Lu Y, Wang Y, Lu Q. Effects of Exercise on Muscle Fitness in Dialysis Patients: A Systematic Review and Meta-Analysis. Am J Nephrol. 2019;50(4):291–302.

7. Pender D, McGowan E, McVeigh JG, McCullagh R. The Effects of Intradialytic Exercise on Key Indices of Sarcopenia in Patients With End-stage Renal Disease: A Systematic Review of Randomized Controlled Trials. Arch Rehabil Res Clin Transl [Internet]. 2023;5(1):100252. Available from: https://doi.org/10.1016/j.arrct.2022.100252

8. Chaovarin C, Chaiprasert A, Satirapoj B, Nata N, Kaewput W, Tangwonglert T, et al. Effect of intradialytic weight resistance training exercise in sarcopenic hemodialysis patients: A randomized controlled trial. Ther Apher Dial. 2024;28(2):182–91.

9. Rosa CS da C, Nishimoto DY, Souza GD e., Ramirez AP, Carletti CO, Daibem CGL, et al. Effect of continuous progressive resistance training during hemodialysis on body composition, physical function and quality of life in end-stage renal disease patients: a randomized controlled trial. Clin Rehabil. 2018;32(7):899–908.

Acknowledgement

This study is a part of activities funded by the Indonesian Endowment Fund for Education (LPDP) on behalf of the Indonesian Ministry of Higher Education, Science and Technology and managed under the EQUITY Program (Contract No. 4300/B3/DT.03.08/2025 and 297/UN3/HK.07.00/2025).

Thank You

Do you have any questions?

Atika.anif.p@fkm.unair.ac.id