

Physical function in children/adolescents with chronic kidney disease and the impact of exercise intervention: A protocol for systematic review and meta-analysis

Supplementary Material

Catalog

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Table S1 The PRISMA-P Checklist

Section and topic	Item No	Checklist item
ADMINISTRATIVE INFORMATION		
Title:		
Identification	1a	Identify the report as a protocol of a systematic review (Title page)
Update	1b	If the protocol is for an update of a previous systematic review, identify as such (Not applicable)
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number (Abstract)
Authors:		
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author (Title page)
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review (Author's contributions)
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments (Not applicable)
Support:		
Sources	5a	Indicate sources of financial or other support for the review (Page 9 Funding)
Sponsor	5b	Provide name for the review funder and/or sponsor (Page 9 Funding)
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol (Not applicable)

INTRODUCTION		
Rationale	6	Describe the rationale for the review in the context of what is already known (Page 3)
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO) (Page 3)
METHODS		
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review (Table 2)
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage (Page 4, Table 1 and Table S2)
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated (Table 1 and Table S2)
Study records:		
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review (Page 4-5)
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis) (Page 4-5)
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators (Page 4-5)
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications (Table 3)
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and

		additional outcomes, with rationale (Table 2)
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis (Page 6)
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised (Page 7)
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2 , Kendall's τ) (Page 7)
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression) (Page 7)
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned (Page 7)
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies) (Page 7)
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE) (Page 8)

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

Table S2 Search detailed for databases.

Embase		
NO.	Elements	Search detail
1	Population	'chronic kidney failure'/exp OR 'chronic kidney failure' OR 'kidney failure'/exp OR 'kidney failure' OR 'renal replacement therapy'/exp OR 'renal replacement therapy' OR 'kidney transplantation'/exp OR 'kidney transplantation' OR 'renal insufficiency':ti,ab,kw OR 'kidney insufficiency':ti,ab,kw OR 'kidney failure':ti,ab,kw OR 'renal failure':ti,ab,kw OR 'kidney disease':ti,ab,kw OR 'renal disease':ti,ab,kw OR 'predialysis':ti,ab,kw OR 'pre-dialysis':ti,ab,kw OR 'end-stage kidney':ti,ab,kw OR 'end-stage renal':ti,ab,kw OR 'endstage kidney':ti,ab,kw OR 'endstage renal':ti,ab,kw OR 'dialysis':ti,ab,kw OR 'hemodialysis':ti,ab,kw OR 'haemodialysis':ti,ab,kw OR 'hemodiafiltration':ti,ab,kw OR 'haemodiafiltration':ti,ab,kw OR 'hemofiltration':ti,ab,kw OR 'haemofiltration':ti,ab,kw OR 'renal transplantation':ti,ab,kw OR 'kidney grafting':ti,ab,kw OR 'kidney transplantation':ti,ab,kw
2	Population	'child'/exp OR 'child' OR 'children':ti,ab,kw OR 'child':ti,ab,kw OR 'adolescent'/exp OR 'adolescent' OR 'adolescents':ti,ab,kw OR 'adolescence':ti,ab,kw OR 'teenagers':ti,ab,kw OR 'teenager':ti,ab,kw OR 'youth':ti,ab,kw OR 'youths':ti,ab,kw OR pediatric:ti,ab,kw
3	Interventions	'sport'/exp OR 'sport' OR 'kinesiotherapy'/exp OR 'kinesiotherapy' OR 'exercise'/exp OR 'exercise' OR 'resistance training':ti,ab,kw OR 'endurance training':ti,ab,kw OR 'physical activity':ti,ab,kw OR 'exercise':ti,ab,kw OR 'yoga'/exp OR 'yoga' OR 'tai chi'/exp OR 'tai chi' OR 'tai chi':ti,ab,kw OR 'taiji':ti,ab,kw OR 'tai ji':ti,ab,kw OR 'tai chi chuan':ti,ab,kw OR 'running':ti,ab,kw OR 'jogging':ti,ab,kw OR 'swimming':ti,ab,kw OR 'walking':ti,ab,kw OR 'cycling':ti,ab,kw OR 'qigong':ti,ab,kw OR 'baduanjin':ti,ab,kw OR 'yoga':ti,ab,kw OR 'pilates':ti,ab,kw
4	Outcomes	'muscle strength'/exp OR 'hand strength'/exp OR 'hand strength':ti,ab,kw OR 'muscle strength':ti,ab,kw OR 'grip strength':ti,ab,kw OR 'hgs':ti,ab,kw OR 'muscle power':ti,ab,kw OR 'muscular force':ti,ab,kw OR 'muscular power':ti,ab,kw OR 'muscular strength':ti,ab,kw OR 'exercise test'/exp OR 'ergometry'/exp OR 'exercise tolerance'/exp OR 'oxygen consumption'/exp OR 'walk test'/exp OR 'cardiorespiratory fitness'/exp OR 'exercise tolerance':ti,ab,kw OR 'physical fitness':ti,ab,kw OR 'exercise test':ti,ab,kw OR 'eurofit test batter*':ti,ab,kw OR 'eurofit test':ti,ab,kw OR 'arm ergometry test':ti,ab,kw OR 'fitness test':ti,ab,kw OR 'cardiopulmonary exercise test*':ti,ab,kw OR 'treadmill test':ti,ab,kw OR 'bicycle ergometry test':ti,ab,kw OR 'ergometr':ti,ab,kw OR 'oxygen consumption':ti,ab,kw OR 'vo2peak':ti,ab,kw OR 'vo2max':ti,ab,kw OR 'aerobic capacity':ti,ab,kw OR 'exercise capacity':ti,ab,kw OR 'cardiorespiratory fitness':ti,ab,kw OR 'aerobic fitness':ti,ab,kw OR 'cardiopulmonary fitness':ti,ab,kw OR 'walk test*':ti,ab,kw OR '6-minute walk distance':ti,ab,kw OR 'six-minute walk

		distance':ti,ab,kw
5	For study 1	#1 AND #2 AND #4
6	For study 2	#1 AND #2 AND #3

Web of Science		
NO.	Elements	Search detail
1	Population	TS=("Renal Replacement Therapy" OR "Renal Insufficiency" OR "Kidney Insufficiency" OR "Kidney failure" OR "Renal failure" OR "Kidney disease" OR "Renal disease" OR "Predialysis" OR "Pre-dialysis" OR "End-Stage Kidney" OR "End-Stage Renal" OR "Endstage Kidney" OR "Endstage Renal" OR "Dialysis" OR "Hemodialysis" OR "Haemodialysis" OR "Hemodiafiltration" OR "Haemodiafiltration" OR "Hemofiltration" OR "Haemofiltration" OR "Renal Transplantation" OR "Kidney Grafting" OR "Kidney Transplantation")
2	Population	TS=("Children" OR "Child" OR "Adolescents" OR "Adolescence" OR "Teenagers" OR "Teenager" OR "Youth" OR "Youths" OR Pediatric)
3	Interventions	TS=("Exercise therapy" OR "Resistance training" OR "Endurance Training" OR "Physical activity" OR "Exercise" OR "T'ai Chi" OR "Tai Chi" OR "Taiji" OR "Tai Ji" OR "T'ai Chi" OR "Tai Chi Chuan" OR "Running" OR "Jogging" OR "Swimming" OR "Walking" OR "Cycling" OR "Qigong" OR "Yoga" OR "Baduanjin" OR "Pilates")
4	Outcomes	TS=("Muscle Strength" OR "Hand strength" OR "Grip Strength" OR "HGS" OR "muscle power" OR "muscular force" OR "muscular power" OR "muscular strength" OR "Exercise test" OR "Ergometry" OR "Exercise tolerance" OR "Physical fitness" OR "Oxygen consumption" OR "Walk test" OR "Cardiorespiratory fitness" OR "exercise tolerance" OR "Eurofit Test Batter*" OR "EuroFit test" OR "Arm Ergometry Test" OR "fitness test" OR "cardiopulmonary exercise test" OR "treadmill test" OR "bicycle ergometry test" OR "ergometr" OR "oxygen consumption" OR "VO2peak" OR "VO2max" OR "aerobic capacity" OR "exercise capacity" OR "cardiorespiratory fitness" OR "aerobic fitness" OR "cardiopulmonary fitness" OR "6-minute walk distance" OR "six-minute walk distance")
5	For study 1	#1 AND #2 AND #4
6	For study 2	#1 AND #2 AND #3

Scopus		
NO.	Elements	Search detail
1	Population	TITLE-ABS-KEY ("Renal Replacement Therapy" OR "Renal Insufficiency" OR "Kidney Insufficiency" OR "Kidney failure" OR "Renal failure" OR "Kidney disease" OR "Renal disease" OR "Predialysis" OR "Pre-dialysis" OR "End-Stage Kidney" OR "End-Stage Renal" OR "Endstage Kidney" OR "Endstage Renal" OR "Dialysis" OR "Hemodialysis" OR "Haemodialysis" OR "Hemodiafiltration" OR "Haemodiafiltration" OR "Hemofiltration" OR "Haemofiltration" OR "Renal Transplantation" OR "Kidney Grafting" OR "Kidney Transplantation")
2	Population	TITLE-ABS-KEY ("Children" OR "Child" OR "Adolescents" OR "Adolescence" OR "Teenagers" OR "Teenager" OR "Youth" OR "Youths" OR Pediatric)
3	Interventions	TITLE-ABS-KEY ("Exercise therapy" OR "Resistance training" OR "Endurance Training" OR "Physical activity" OR "Exercise" OR "T'ai Chi" OR "Tai Chi" OR "Taiji" OR "Tai Ji" OR "T'ai Chi" OR "Tai Chi Chuan" OR "Running" OR "Jogging" OR "Swimming" OR "Walking" OR "Cycling" OR "Qigong" OR "Baduanjin" OR "Yoga" OR "Pilates")
4	Outcomes	TITLE-ABS-KEY ("Muscle Strength" OR "Hand strength" OR "Grip Strength" OR "HGS" OR "muscle power" OR "muscular force" OR "muscular power" OR "muscular strength" OR "Exercise test" OR "Ergometry" OR "Exercise tolerance" OR "Physical fitness" OR "Oxygen consumption" OR "Walk test" OR "Cardiorespiratory fitness" OR "exercise tolerance" OR "Eurofit Test Batter*" OR "EuroFit test" OR "Arm Ergometry Test" OR "fitness test" OR "cardiopulmonary exercise test" OR "treadmill test" OR "bicycle ergometry test" OR "ergometr" OR "oxygen consumption" OR "VO2peak" OR "VO2max" OR "aerobic capacity" OR "exercise capacity" OR "cardiorespiratory fitness" OR "aerobic fitness" OR "cardiopulmonary fitness" OR "6-minute walk distance" OR "six-minute walk distance")
5	For study 1	#1 AND #2 AND #4
6	For study 2	#1 AND #2 AND #3

Table S3 List of studies excluded at full-text review and reasons for exclusion.

NO.	References	Reasons
1		Reason 1
2		Reason 2
3		Reason 3
4		Reason 4
5		Reason 5

Table S4 Characteristic of the included clinical intervention studies

Author (year)	Study design	Stage of CKD	Mean age at baseline	Gender (F/M)	Intervention	Outcome	Results (baseline)	Results (endpoint)
Abd-Elmonem AM (2019) [1]	RCT	Stage 3-4	E: 9.87±1.36 C: 10.62±1.25	Not reported	Frequency: 2 times/week Intensity: 60-75% 1RM Type: resistance training Time: 60 min Duration: 6 months	6MWT	E: 424.37±32.96 C: 435.62±26.57	E: 522.5±32.96 C: 430±25.03
Goldstein SL (2009) [2]	Single arm	HD (N=21)	13.6 (range: 8-25)	9/12	Frequency: 2 times/week Intensity: not reported Type: aerobic exercise Time: 30-60 min Duration: 12 weeks	6MWT	589±90	627±86
						HGS	23.2±10.9	26.6±12.4

Table S5 Characteristic of the included observational studies

Author (year)	Stage of CKD	CKD group	Control group	Physical function assessment	Result
Weigmann-Faßbender S (2020) [3]	KTRs	N=20, 13.5±3.4, 80% M	N=33, 13.1±3.2, 75.8%	Cardiorespiratory fitness: VO ₂ peak	CKD group: 28.6±7.8 mL/min/kg Control group: 41.7±8.5 mL/min/kg
Derakhshan A (2014) [4]	KTRs	N=44, 16±3.1, 59.1% M	N=30, 17.4±2.62, 56.7%	Cardiorespiratory fitness: VO ₂ Max	CKD group: 30±5.42 L/min Control group: 40.52±5.65 L/min
Sethna CB (2009) [5]	KTRs	N=50, 14.5±3.0, 70% M	N=70, 14.9±3.7, 40% M	Cardiorespiratory fitness: VO ₂ Max	CKD group: 29.6±7.7 mL/kg/min Control group: 31.5±7.8 mL/kg/min

Table S6 Example of subgroup analysis

Outcomes	Subgroup	Number of studies	Effect size (95% CI)	P-value
Outcome 1	Children			
	Adolescents			
Outcome 2	Predialysis			
	Dialysis			
	KTRs			

Table S7 GRADE evidence profile

Certainty assessment						No. of participants		Effect size	Certainty (High Moderate Low Very low)
No. of study (design)	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Exercise group	Control		

Reference

1. Abd-Elmonem AM, Al-Tohamy AM, Galal RE, Abd-Elhalim FA: **Effects of progressive resistance exercises on quality of life and functional capacity in pediatric patients with chronic kidney disease: a randomized trial.** *J Musculoskelet Neuronal Interact* 2019, **19**(2):187-195.
2. Goldstein SL, Montgomery LR: **A pilot study of twice-weekly exercise during hemodialysis in children.** *Pediatr Nephrol* 2009, **24**(4):833-839.
3. Weigmann-Fassbender S, Pfeil K, Betz T, Sander A, Weiss K, Tonshoff B, Friedmann-Bette B: **Physical fitness and health-related quality of life in pediatric renal transplant recipients: An interventional trial with active video gaming.** *Pediatr Transplant* 2020, **24**(1):e13630.
4. Derakhshan A, Derakhshan D, Amoozgar H, Shakiba MA, Basiratnia M, Fallahzadeh MH: **Exercise test in pediatric renal transplant recipients and its relationship with their cardiac function.** *Pediatr Transplant* 2014, **18**(3):246-253.
5. Sethna CB, Salerno AE, McBride MG, Shults J, Paridon SM, Sharma N, Meyers KE, Leonard MB: **Cardiorespiratory fitness in pediatric renal transplant recipients.** *Transplantation* 2009, **88**(3):395-401.