

Effect of Comprehensive Renal Rehabilitation in Hemodialysis: Systemic Review

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KEYWORDS

Renal rehabilitation,
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ABSTRACT:

Background: Renal rehabilitation is a multimodal, coordinated intervention aimed at improving a patient's physical, psychological, and social functioning. Additionally, a growing body of research indicates that exercise training improves left ventricular function, cardiac sympathetic and parasympathetic disharmony, as well as Vo2 max in hemodialysis patients. Purpose: To systematically summarize the randomized controlled studies and investigated the effect of comprehensive renal rehabilitation in hemodialysis. Data source: Four electronic data base (PubMed, Pedro, Cochrane and Google scholar) were searched from 2014 till 2024. Study selection: Two independent reviewers screened studies for eligibility first by title then by title then by abstract then finally full text. Data extraction: Fourteen studies met the inclusion criteria of this review, all of them were about comprehensive renal rehabilitation in hemodialysis studies quality was assessed using Pedro and the Cochrane risk of bias assessment tool. Data synthesis: Fourteen studies were included in the quality assessment, studies were of good quality while the rest were fair quality on the Pedro scale, studies state that. Results: Met-analysis showed that there was significant effect of comprehensive renal rehabilitation in hemodialysis in the outcome measurers (Fatigue level, Vo2 max, muscle strength, physical, mental function and blood pressure change). Conclusion: This analysis showed that there were effects of comprehensive renal rehabilitation in hemodialysis.

1. Introduction

Renal Rehabilitation “RR is coordinated, multifaceted interventions designed to optimize a renal patient’s physical, psychological, and social functioning, in addition to stabilizing, slowing, or even reversing the progression of renal deterioration, thereby reducing morbidity and mortality. RR includes five major components: such as exercise training, diet & fluid management, medication & medical surveillance, education, psychological & vocational counseling”. For RR to be effective, it is necessary to meet certain clinical requirements, such as controlled anemia, sufficient dialysis, regular exercise, a healthy diet, and a functioning vascular access ⁽¹⁾.

The Chronic kidney disease (CKD) is characterized by kidney damage or a glomerular filtration rate (GFR) below 60 mL/min/1.73 m², persisting for three months or more. The GFR categorizes chronic kidney disease (CKD) into five stages, ranging from stage 1 with a GFR > 90 mL/min/1.73 m² (indicating kidney damage with normal or elevated renal function) to stage 5 with a GFR < 15 mL/min/1.73 m² (indicating kidney failure requiring hemodialysis). Age, hypertension, and diabetes are the primary determinants of newly developed secondary CKD. The significant prevalence and incidence of CKD and end-stage renal disease (ESRD) constitute a worldwide issue.

Exercise capacity, a critical predictor of all-cause mortality in both health and disease, is markedly diminished in CKD patients undergoing dialysis. Moreover, sedentary dialysis patients exhibit a 62% increased mortality risk relative to their non-sedentary counterparts ⁽²⁾. The primary factors contributing to physical activity impairments include cardiac (central) dysfunction, muscle (peripheral) dysfunction, and malnutrition. A recently published meta-analysis indicated that exercise in hemodialysis (HD) patients enhances cardiovascular function, functional capacity, as well as quality of life (QoL). ⁽³⁾.

Patients undergoing dialysis have a significantly elevated incidence (>60%) of cardiovascular problems including hypertension, coronary heart disease (CHD), congestive heart failure (CHF), as well as arrhythmias, which continue to be the primary contributors to mortality and morbidity ⁽⁴⁾. CHD is linked to both conventional risk factors (such as diabetes, hypertension, and a sedentary lifestyle) along with nontraditional

risk factors (including bone disease, anemia, inflammation, as well as oxidative stress), in addition to those related to dialysis. It was suggested that a decline in physical activity levels over time among dialysis patients may elevate the risk of arteriosclerosis ⁽⁶⁾.

Purpose of the study:

1- To systematically summarize the randomized controlled studies and observational studies that investigated the effect of comprehensive renal rehabilitation in hemodialysis systemic review and meta-analysis.

2. Methodology

This chapter includes criteria for considering trials for current systematic review, as well search strategy.

Criteria for considering trails for current review

Trials type:

Randomized controlled trials (RCTs) (were selected in current review. a) Clinical trial design was prospective one that involved compared groups. b) Trials reported quantitative measures. c) Trials evaluated interventions effect of comprehensive renal rehabilitation in hemodialysis.

The study question was:

What was the effect of comprehensive renal rehabilitation in hemodialysis systemic review and Meta-analysis?

Outcomes Measures:

- Primary outcome
 - Functional balance
 - Fatigue
 - Six-minute walking test (6MWT)
 - Change of systolic blood pressure
 - Change of peak Vo2 max
 - Change of physical component score
- Secondary outcome
 - Muscle strength (hand grip)
 - Change of mental component score

Information sources and search strategy

Electronic search was performed in PubMed, Web of science, Embase, SAGE, Scopus databases for observational and randomized controlled studies published in English and indexed from inception till 2024. The search strategy was consisted of a mix of free text terms as well as medical subject headings (MeSH) related to ("renal rehabilitation" OR "kidney rehabilitation" OR "Renal hemodialysis " OR "Dialysis exercise" OR "Intradialytic" OR "Chronic kidney disease" OR " rehabilitation role in chronic kidney" OR "Disability and Rehabilitation " OR " intervention in CKD elder subjects" OR "Exercise training "OR" Kidney disease " OR " Hemodialytic patients" OR " disease and disability" OR " Chronic Kidney Disability " OR "" OR "Rehabilitation intervention" OR " Elder subjects" .

Also, the lists of references of all relevant studies were reviewed to search for more related studies that are not detected by electronic searches.

Eligibility criteria:

In this study, we had included only observational case-control and cohort studies and randomized control studies. The following criteria were used to determine which studies were included:

- 1) Studies involved healthy subjects from 30 to 60 years old.

- 2) Studies had to be written in English.
- 3) The search had been started from inception till 2024.
- 4) Studies investigated The Effect of Comprehensive Renal Rehabilitation In Hemodialysis Systemic Review and Meta-Analysis before and after application the rehabilitation
- 5) Body mass index from normal up to 30.

Exclusion criteria:

1. Research articles published in languages other than English.
2. Conference proceedings, editorials, letters, and poster presentations.

Study selection and data extraction:

Following the elimination of duplicates with EndNote program version 20, retrieved articles were evaluated for relevance based on titles and abstracts by two independent investigators. Subsequently, the two investigators evaluated the full-text versions of pertinent papers to determine their eligibility.

Two reviewers separately extracted the relevant data. Their findings were compared to determine whether all relevant data had been correctly extracted. The collected items include authors, publication year, title, study design, subject characteristics, rehabilitation intervention, outcomes, as well as conclusions.

Risk of bias assessment:

1-For observational studies:

The included articles were assessed, independently by the two investigators, according to the Newcastle Ottawa quality assessment scale (NOS): case-control studies. The choice for this quality assessment method was based on the fact that most included articles were cross-sectional studies ⁽⁷⁾. If there is the need to reach a consensus, as the 2 investigators are in disagreement about the results of the selection, a third investigator was asked ⁽⁸⁾.

The NOS employs a (star rating system) that evaluates a study based on three criteria: ascertainment of the exposure or outcome of interest, comparability of the study groups, as well as selection of the study groups. Each aspect comprises multiple items that received a score of one star, with the exception of comparability, which may attain a maximum score of two stars ⁽⁹⁾. The quality rating is considered good if the score is 7 or above, fair if the score is 5 or higher, and poor if the score is less than 5. Cohen's kappa was employed to evaluate the degree of concordance among the two reviewers ⁽¹⁰⁾.

2-For randomized control studies:

The evaluation of bias risk was deemed a crucial element of a systematic review about the effects of an intervention. The most often utilized instrument for randomized studies is the Cochrane risk-of-bias tool. The update was implemented to reflect advancements in the comprehension of bias emergence in randomized trials and to incorporate user feedback along with the limitations identified in the original tool ⁽¹¹⁾.

Measures of effect:

Data were presented as Standardized mean difference of Functional balance, Fatigue, Six minute walking test (6MWT), Muscle strength (hand grip), Change of systolic blood pressure, Change of peak Vo2 max, Change of physical component score. A random model was chosen to adjust for heterogeneity while a forest plot was used for visualization of the effect size. Moreover, the egger test was used to assess the symmetry of studies in the funnel plot (publication bias assessment).

Materials that were used:

Endnote program was used for the detection of duplicate publications and removing them. A comprehensive meta-analysis program was used for statistical data processing to measure the effect of comprehensive renal rehabilitation in hemodialysis systemic review and meta-analysis.

Study Selection criteria:

The titles and abstracts of trials identified through electronic searches were assessed by two independent reviewers, subsequently, full text of remaining clinical trials were obtained, also eligibility checked against current review inclusion as well as exclusion criteria to exclude trials that do not fulfill current inclusion criteria.

Data Extraction

Direct data extracted from original published articles then been tabulated in data extraction a sheet that determines general information regarding trials and participants characteristics, plus intervention, procedures, outcome measures, key results, and conclusions.

Methodological Quality:

Full published trials were evaluated for their methodological quality using the following criteria: COCHRANE risk for bias assessment tool, the Physical Therapy Evidence Data Base Scale (Pedro) for evaluation of eligibility criteria, randomization and blinding methods, allocation concealment, study group similarity prior to clinical trial start, intention-to-treat analysis, trial population lost to follow-up, and missing values.

Clinical RCTs held 9- 10 points on the basis of Pedro's scale were classified as excellent, where trials held 6-8 points on the basis of Pedro's scale were defined as good, while trials held 4-5 points on the basis of Pedro's scale were defined to be average, as well trials held 0-3 points on the basis of Pedro's scale were classified as poor.

Measuring therapeutic effect:

Both primary and secondary outcome measures were determined as continuous ones. Change of data scores in between before and after intervention ones were assessed then defined in means as well as standard deviations (SDs), plus standardized mean difference (SMD) using 95% confidence intervals (CIs) per trial was measured. Pooled data through calculation of overall SMD and 95% CI.

Data Synthesis:

Extracting data per identified trial across current systematic review, followed by comparing data then findings represented either quantitatively, qualitatively, or both based on homogeneity between trials. This systematic review used met-analysis in its data synthesis due to the homogeneity of its data.

Registration of the review

This systematic review as well as meta-analysis were registered in the PROSPERO database.

Statistical analysis:

This meta-analysis combined data at the study level. The outcome exercise capacity, cardiovascular fitness, and quality life variables are evaluated at the conclusion of the intervention period in hemodialysis patients. The exercise capacity is assessed by functional balance, fatigue, six-minute walking test (6MWT), single pool, muscle strength (hand grip). The cardiovascular fitness is assessed by change of systolic blood pressure, change of diastolic blood pressure, as well as change of peak Vo2 max. The quality of life is evaluated by the alteration in physical component score as well as the modification of physical component score. To facilitate the comparison of data across several scales, pooled statistics were calculated utilizing standardized mean differences (SMDs), which were derived using the Review Manager program (RevMan software, version 5). The means, mean change, as well as standard deviations (SDs) for both the intervention and control groups were utilized to calculate SMDs. Each study that was included in the meta-analysis had its forest plots computed using the means, SD, as well as sample size effect for the intervention group versus the control group. If the outcome variable was reported in ≥ 2 studies and the action research outcome is continuous, the estimated effect size was calculated as needed.

The random-effects model was employed to analyze the outcome variables from all eligible acute studies and all eligible intervention studies that were gathered from the review. The outcome variables were aggregated across studies. Action research rehabilitation outcomes measures with 95% confidence intervals were used to investigate differences. Heterogeneity measures the variability between studies using the I^2 statistic to quantify the proportion of the total outcome attributed to variability among studies. Study variability and heterogeneity

was tested by random effects model and I^2 statistic (Higgins and Gered, 2011). The following values were used: $I^2=0\%-30\%$ (no heterogeneity); $I^2=30\%-49\%$ (moderate heterogeneity); $I^2=50\%-74\%$ (substantial heterogeneity); and $I^2=75\%-100\%$ (considerable heterogeneity). The statistical analysis was conducted by using Review Manager Program for windows (RevMan software, version 5.4.1).

3. Results

Literature search results

This study was conducted to systematically summarize the randomized controlled studies and observational studies that investigated the effect of comprehensive renal rehabilitation in hemodialysis.

Current study search was conducted from 2014 till 2024, 975 published studies were identified from search of Cochrane, PubMed, Pedro databases and Google scholar. After excluding all duplicate studies, 918 study excluded by title and Then, 26 study excluded by abstract. Then 10 studies were excluded by full text and 21 studies included by in qualitative synthesis and 14 studies included in the meta-analysis met the inclusion criteria of this review, all of them were about effect of comprehensive renal rehabilitation in hemodialysis.

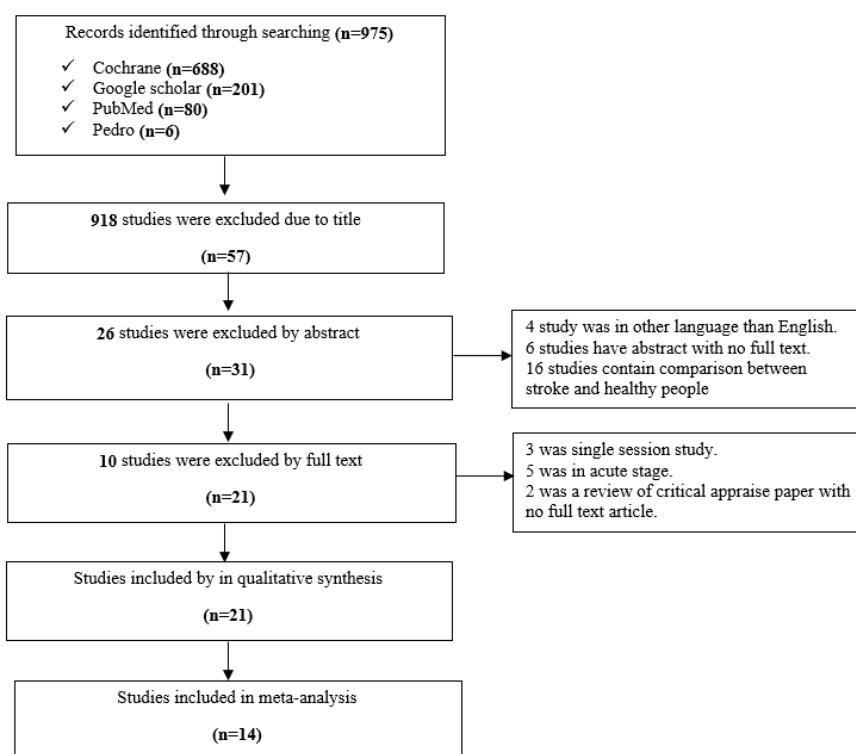


Figure (1): Flow diagram of search results

Table (1): General characteristics of the included studies in the review:

No.	Reference	Intervention vs control	Procedure	Frequency	Outcome	Conclusion
1	Rossi et al., 2014	Stretch-strengthening exercise cardiac rehabilitation	Guited exercise group versus control group	• Two time/ week for 12 week	Physical function, health related quality of life were measured	Renal rehabilitation exercise improves physical capacity as well as quality of life among patients having chronic kidney disease
2	Groussard et al., 2015	Intradialytic exercise in intervention group versus control group	Intra biolytic/ cycle training with 55-60 % of Maximum heart rate for 30 minutes	• 3 times/ week for 3 month	Difference in Vo2 max was measured	Intra biolytic exercise can had positive effect an cardiopulmonary from among chronic kidney disease patients
3	McGregor et al., 2018	Stationary bicycle aerobic	Two half hours with 5 minute interval using	• 3 time/week for 8 weeks	Exercise capacity , O2 pressure and left	Aerobic training exercise with different intensity can improve general health and

No.	Reference	Intervention vs control	Procedure	Frequency	Outcome	Conclusion
		exercise versus control group	stationary bicycle with 65-75% of maximum		ventricular function were measured	exercise capacity in chronic kidney disease patients
4	Abdelaal & Abdelazi, 2019	Aerobic training group versus resisted training group versus control group	Aerobic training with 55% of maximum heart rate resistance training with two set of repetition with 70% of one repetition maximum	• 3 time/ week/ 12 weeks	Six minute walking test, resting heart rate, systolic and diastolic blood pressure along with berg balance scale were used for assessment	Both aerobic exercise as well as resistance training have favorable effect in patients with renal hemodialysis
5	Thompson et al., 2019	Aerobic based exercise intervention versus usual care control group	Moderate intensity aerobic exercise with isometric resistance exercise	• 3 times/week for 16 weeks	Ambulatory systolic blood pressure pulse wave velocity, daily dose of hypertension and cardio vascular risk markers were measured	Exercise had an effect among patients having moderate to severe chronic kidney disease
6	Sutinah et al., 2020	Breathing relaxation exercise group versus control group	Breathing relaxation exercise used with deep diaphragmatic breathing exercise	• 15 minute daily	Fatigue assessment scale	Reduction of fatigue with deep berating exercise
7	Myers et al., 2021	Aerobic and resistance exercise programe versus control group	Aerobic and resistance exercise by treadmill and arm ergometer exercise	• 12 weeks with (13 exercise and 15 usual care) daily	Peak VO2 max, ventilatory inefficiency, 6 minute walking test, 1 minute sit to stand, muscle strength quality of life were assessed prior to and following	Aerobic as well as resisted exercise can increase aerobic capacity and quality of life
8	Aboelmagd et al., 2021	Incentive spirometer training versus control group	Inspiratory muscle training by utilizing incentive spirometer	• 3 times / week / 8 weeks	Diaphragmatic mobility, arterial blood gases as well as functional capacity assessment were measured	It is advised that patients having chronic kidney disease who receive hemodialysis incorporate incentive spirometer training into their daily routine.
9	Yuenyongchaiwat et al., 2021	Inspiratory muscle training group versus control group	Inspiratory muscle training during hemodialysis (deep breathing exercise)	• 3 times/ week for 8 week	Pulmonary function, Respiratory muscle strength as well as quality of life were measured	Inspiratory training during hemodialysis could lead to improvement in respiratory fitness
10	Elgendi and Khalifa, 2023	Pedaling exercise intervention versus control group	Pedaling exercise for > 10-15 minute during hemodialysis	• 3 times/ week for 6 weeks	Blood pressure was measured at baseline as well as following 6 weeks of training	Pedaling exercise can lower blood pressure among patients with chronic kidney disease
11	Takamatsu et al., 2024	Aerobic exercise programe with moderate intensity versus control group	Including application of weight on lower limb at Ankle-Knee-hip joint with physiological movement	• 3 times/ week for 24 week	Blood pressure pulse rate body pain physical function, social function and mental health were measured	Supervised self exercise progmae during dialysis lead to improvement of physical and psychological function.
12	Abde-Kader et al., 2024	Study group with aerobic exercise versus control group with resisted exercise	Cycle ergometer aerobic exercise training at an intensity of 60-70% of each individual's maximum heart rate. Resisted training with different 8 resistance machine with intensity 60-70 % of each individual maximal heart rate	• 3 times / week for 6 month	Six minute walking test, hand grip strength and fatigue assessment were measured	Arabic exercise alleviate fatigue and improve exercise tolerance more effective than resisted exercise among hemodialysis patients

No.	Reference	Intervention vs control	Procedure	Frequency	Outcome	Conclusion
13	Javeria schar et al., 2024	Deep breathing with isometric hand grip exercise group versus control group	Deep breathing exercise with hand grip exercise during dialysis	• 3 times/ week for 8 week	Chest expansion, hand grip and quality of life were measured	Deep breathing and isometric exercise enhance chest expansion in chronic kidney disease patients
14	Kiraly et al., 2024	Moderate intensity endurance exercise with core stability versus control group exercise	10 minutes warming up at lowest resistance level up on indoor bike	• Moderate intensity physical activity not exceeding 50-60% of heart rate range • Gradually increase the intensity and time of the exercise • Core stability training and stability training of the spine.	Six minute walking test, visual analogue scale along with health related quality of life was measured	Structured exercise program could be effective therapies in chronic kidney disease.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Abd E-Kader et al., 2024	+	+	+	+	+	+	
Abdelaal and Abdulaziz, 2019	+	+	+	+	+	+	
Aboelmagd and Ismail, 2021	+	+	+	+	+	+	
Elgendi and khalifa, 2023	+	+	+	+	+	+	
Groussard et al., 2015	+	+	+	+	+	+	
Király et al., 2024	+	+	+	+	+	+	
McGregor et al., 2018	+	+	+	+	+	+	
Myers et al., 2021	+	+	+	+	+	+	
Rossi et al., 2014	+	+	+	+	+	+	
Sehar et al., 2024	+	+	+	+	+	+	
Sutinah, 2020	+	+	+	+	+	+	
Takamatsu et al., 2024	+	+	+	+	+	+	
Thompson et al., 2019	+	+	+	+	+	+	
Yuenyongchaiwat et al., 2021	+	+	+	+	+	+	

Figure (2): Risk of bias summary review authors' judgments about each risk of bias item for each included study.

A. Hemodialysis patient's age

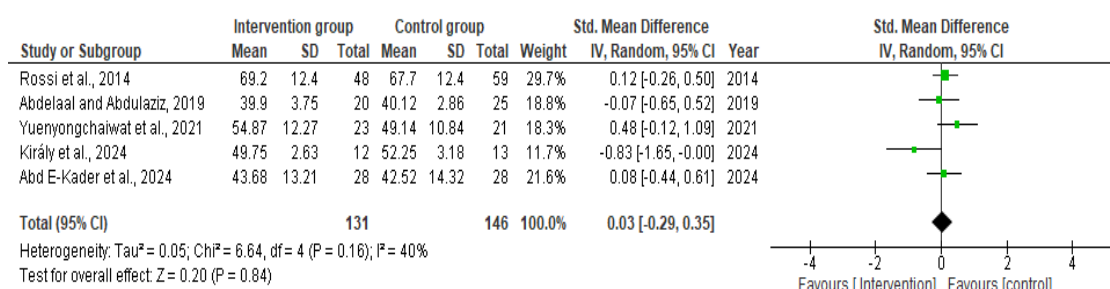


Figure (3): Forest plot (1): Standardized mean differences (95% CI) of hemodialysis patient's age from 5 trails.

B. Effect of exercise training on exercise capacity in hemodialysis patients

1. Functional balance

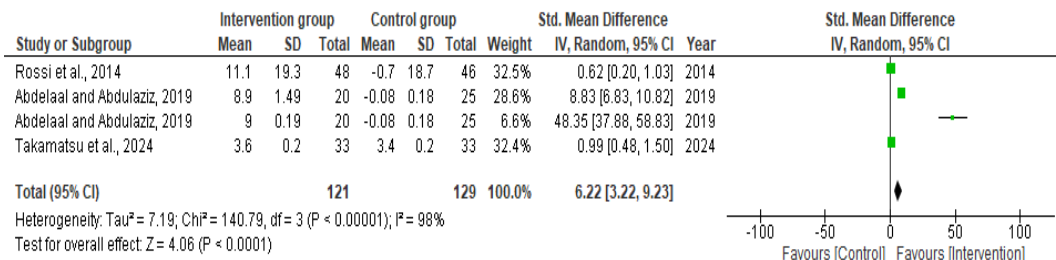


Figure (4): Forest plot (2): Standardized mean differences (95% CI) of exercise capacity by functional balance after assisted as compared with a control from 4 studies.

2. Fatigue:

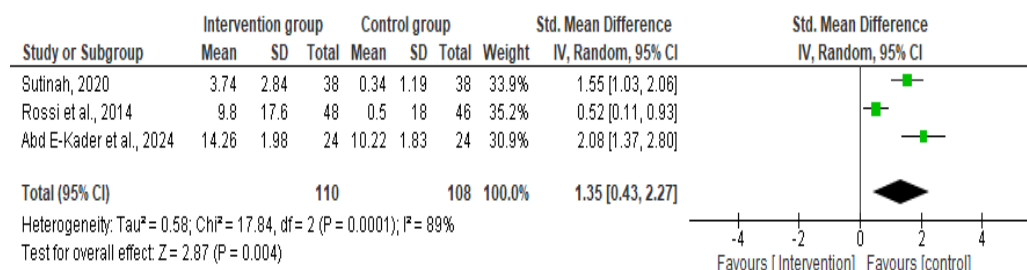


Figure (5): Forest plot (3): Standardized mean differences (95% CI) of exercise capacity by fatigue after assisted as compared with a control from 3 trails

3. Six-minute walking test (6MWT):

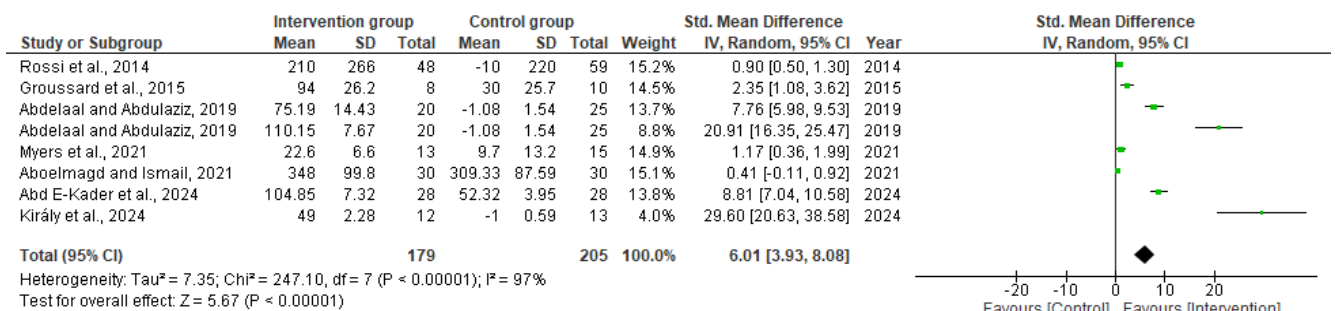
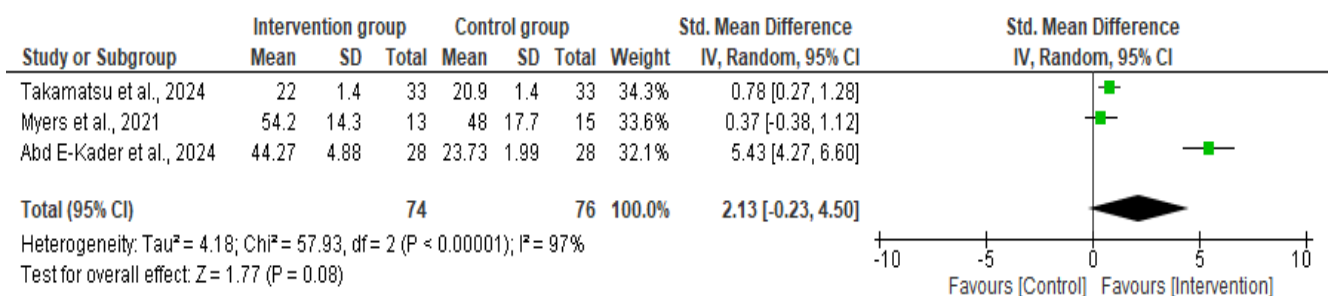


Figure (6): Forest plot (4): Standardized mean differences (95% CI) of exercise capacity by 6MWT after assisted as compared with a control from 8 trails.

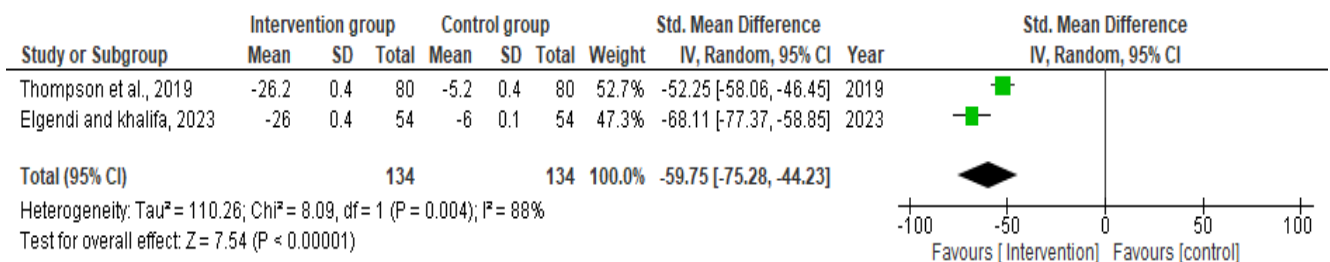
4. Muscle strength (hand grip):



Figures (7): Forest plot (5): Standardized mean differences (95% CI) of exercise capacity by hand grip after assisted as compared with a control from 3 trails.

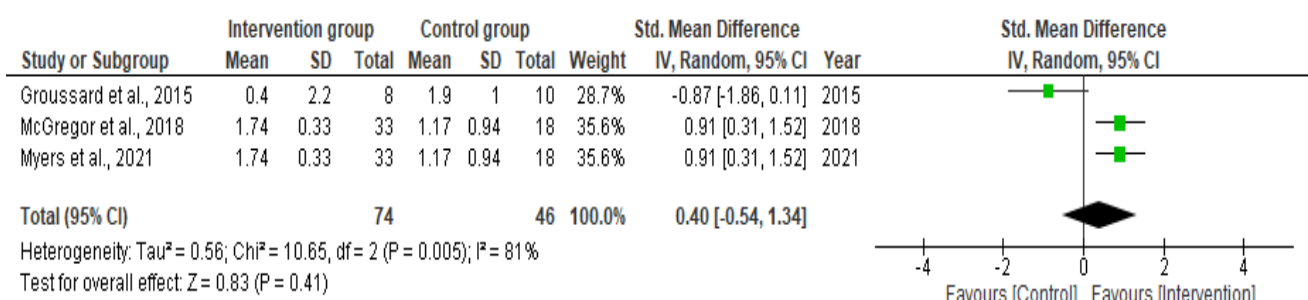
C. Effect of exercise training on cardiovascular fitness in hemodialysis patients

1. Change of systolic blood pressure



Figures (8): Forest plot (6): Standardized mean differences (95% CI) of cardiovascular fitness by change of systolic blood pressure after assisted as compared with a control from 6 trails.

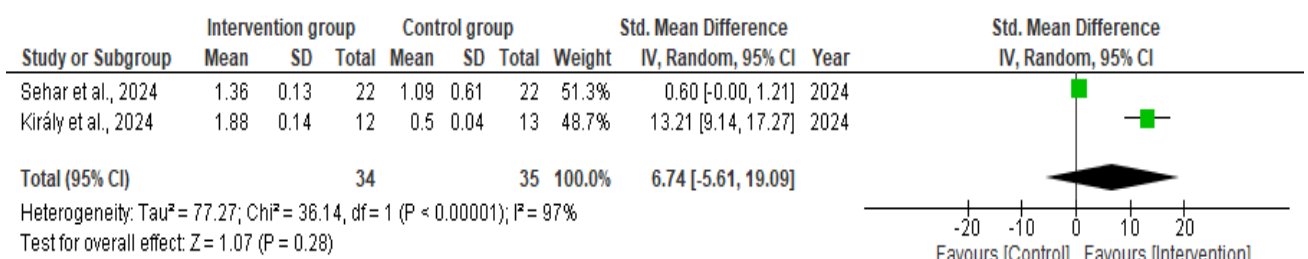
2. Change of peak Vo_2 max



Fingers (9): Forest plot (7): Standardized mean differences (95% CI) of cardiovascular fitness by peak Vo_2 max after assisted as compared with a control from 3 trails.

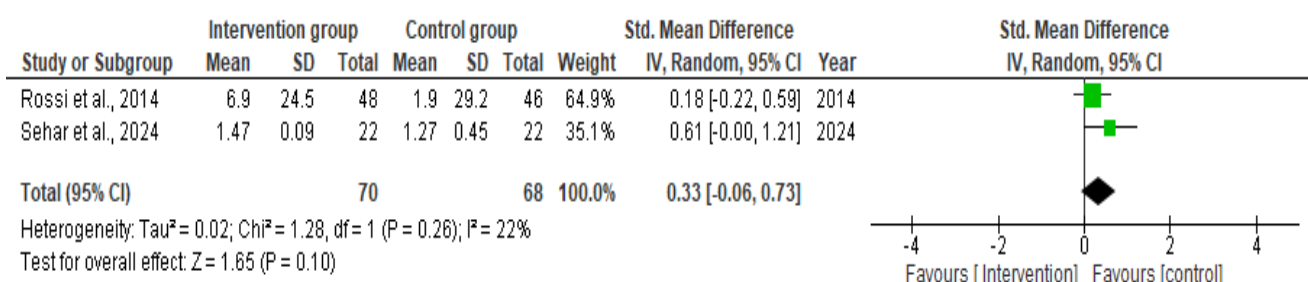
E. Effect of exercise training on quality of life in hemodialysis patients

1. Change of physical component score



Figures (10): Forest plot (8): Standardized mean differences (95% CI) of quality of life by physical component score after assisted as compared with a control from 2 trails.

2. Change of mental component score



Figures (11): Forest plot (9): Standardized mean differences (95% CI) of quality of life by change of mental component score after assisted as compared with a control from 2 trails.

4. Discussion

Current review main purpose was to systematically analysis the impact of renal rehabilitation among chronic kidney disease (CKD) patients, fourteen trial were involved in the meta-analysis comparing the impact of different rehabilitation methods among CKD patients determining post rehabilitation phase de fined as an important issue, plus therapeutic frequency and outcome evaluated based on clinical decision taken, here in our study, we included trials in End stage of kidney disease or CKD with hemodialysis to compare long term effect of the interventions on fatigue level, VO₂ max, physical function, mental function, muscle strength and blood pressure changes in chronic kidney disease with hemodialysis.

The reviews results revealed that there were significant difference with physical therapy and rehabilitation interventions in chronic kidney disease patients that was supported by systematic review which revealed that there were effect of different types of exercise on cardiorespiratory fitness as well as physical function among patients suffering from CKD with hemodialysis .

Eight trails assessed exercise capacity by 6MWT between intervention group and control group (Forest plot 4). There was considerable heterogeneity ($P<0.00001$; $I^2=97\%$) in 6MWT between 8 trails involving 179 participants in the intervention group as well as 205 participants in the control group totally. There was substantial difference ($P<0.00001$; $P<0.05$) in 6MWT (SMD= 6.01; 95% CI, 3.93 to 8.08) between intervention group and control group.

Three trails assessed exercise capacity by muscle strength (hand grip) between intervention group and control group (Forest plot 5). There was considerable heterogeneity ($P<0.00001$; $I^2=97\%$) in hand grip between 3 trails involving 74 participants in the intervention group as well as 76 participants in the control group totally. There was no substantial difference ($P=0.08$; $P>0.05$) in hand grip (SMD= 2.13; 95% CI, -0.23 to 4.50) among intervention group as well as control group.

Two trails assessed cardiovascular fitness by change of systolic blood pressure among intervention group as well as control group (Forest plot 6). There was considerable heterogeneity ($P=0.004$; $I^2=88\%$) in change of systolic blood pressure between 2 trails involving 134 participants in the intervention group as well as 134 participants in the control group totally. There was substantial difference ($P<0.00001$; $P<0.05$) in change of systolic blood pressure (SMD= -59.75; 95% CI, -75.28 to -44.23) among intervention group as well as control group.

Three trails assessed cardiovascular fitness by change of peak Vo₂ max between intervention group and control group (Forest plot 7). There was considerable heterogeneity ($P=0.005$; $I^2=81\%$) in change of peak Vo₂ max between 3 trails involving 74 participants in the intervention group as well as 46 participants in the control group totally. There was no substantial difference ($P=0.41$; $P>0.05$) in change of peak Vo₂ max (SMD= 0.40; 95% CI, -0.54 to 1.34) among intervention group as well as control group.

Two trails assessed quality of life by change of physical component score between intervention group as well as control group (Forest plot 8). There was considerable heterogeneity ($P<0.00001$; $I^2=97\%$) in change of physical component score between 2 trails involving 34 participants in the intervention group and 35 participants in the control group totally.

Two trails assessed quality of life by change of mental component score between intervention group as well as control group (Forest plot 9). There was no heterogeneity ($P=0.26$; $I^2=22\%$) in change of mental component score between 2 trails involving 70 participants in the intervention group as well as 68 participants in the control group totally. There was no substantial difference ($P=0.010$; $P>0.05$) in change of mental component score (SMD= 0.33; 95% CI, -0.06 to 0.73) among intervention group as well as control group.

Current review utilized numerous methodological domains; adequate sequence generation and allocation concealment plus blinding assessors in line to evaluate risk of bias in identified trials. All involved clinical trials have random participants allocation, allocation concealment was verified only by four trials (Rossi et al., 2014; Elgendi and Khalifa et al., 2024). As well baseline characteristics similarity was ensured for all involved trials except for (Kiralay et al., 2024; Sutinah et al., 2020; Groussard et al., 2015).

Neither participants nor therapists blinding were verified across all involved trials, but all identified trials held assessors blinding, except (Abdelaal et al., 2019; Sutinah et al., 2020).

Most of involved trials were well defining therapeutic interventions; plus a clear determining outcome measure utilized.

Pedro scale was verified for investigating current methodological quality of involved trials, with median Pedro scale was that over all good quality of trials. While all identified trials on ROB2 tool for involved trials quality evaluation was between some concerns. Such findings spotlight that there is a difference in the methodological quality of the included studies between the risk of bias scale as well as the Pedro scale leading to different.

However, this review had some limitations shall be highlighted first issue was homogeneity concerning follow up weeks of identified trials were varied thus prevent completion met analysis regarding follow up for extended periods. Second item limited identified I trials down grade overall quality of evidence, with respect to revealed homogeneity within outcome measures. Evidence "non-significant benefits" might be verified based on small sample size than ineffective therapeutic interventions. Finally, measured quality of involved trials was high risk that downgrades overall quality of evidence plus results.

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