

Supplementary Information

Exercise effects on balance confidence and concerns about falling in older adults with cognitive impairment: a construct-stratified meta-analysis

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Supplementary methods, study-level data, sensitivity analyses, risk-of-bias and GRADE profiles, and PRISMA 2020 checklists

Prepared as a single composite Supplementary Information file for Scientific Reports.

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Supplementary Methods: Information sources, search dates, and complete search strategies

Search date and coverage. Seven electronic sources were searched from inception to 1 July 2026. Reference lists of included studies and relevant systematic reviews were also screened; no additional eligible records were identified from other sources.

Supplementary Table S1. Electronic information sources and search yields

Source	Coverage	Records retrieved
PubMed	Database/platform inception to 1 July 2026	2,496
Web of Science Core Collection	Database/platform inception to 1 July 2026	3,156
Embase	Database/platform inception to 1 July 2026	12,276
Cochrane Library	Database/platform inception to 1 July 2026	338
Scopus	Database/platform inception to 1 July 2026	6,225
Wiley Online Library	Database/platform inception to 1 July 2026	1,321
CINAHL	Database/platform inception to 1 July 2026	2,251
Total	-	28,063

Note: The record counts reproduce the numbers used in the PRISMA 2020 flow diagram; total records = 28,063.

PubMed

Search date: 1 July 2026. Coverage: database/platform inception to search date. Yield: 2,496 records.

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( "Cognitive Dysfunction"[Mesh] OR "Neurocognitive Disorders"[Mesh] OR "Dementia"[Mesh] OR "Alzheimer Disease"[Mesh] OR "Dementia, Vascular"[Mesh] OR "Frontotemporal Dementia"[Mesh] OR "Lewy Body Disease"[Mesh] OR "mild cognitive impairment"[tiab] OR MCI[tiab] OR "cognitive impairment"[tiab] OR "cognitive impairments"[tiab] OR "cognitively impaired"[tiab] OR "cognitive decline"[tiab] OR "mild neurocognitive disorder"[tiab] OR "mild neurocognitive disorders"[tiab] OR "major neurocognitive disorder"[tiab] OR "major neurocognitive disorders"[tiab] OR dementia*[tiab] OR Alzheimer*[tiab] OR "mild dementia"[tiab] OR "moderate dementia"[tiab] OR "mild-to-moderate dementia"[tiab] OR "mild to moderate dementia"[tiab] OR "vascular cognitive impairment"[tiab] OR "vascular dementia"[tiab] OR "Lewy body dementia"[tiab] OR "dementia with Lewy bodies"[tiab] OR "frontotemporal dementia"[tiab] ) AND ( "Exercise"[Mesh] OR "Exercise Therapy"[Mesh] OR "Exercise Movement Techniques"[Mesh] OR "Physical Conditioning, Human"[Mesh] OR "Resistance Training"[Mesh] OR "Endurance Training"[Mesh] OR "Walking"[Mesh] OR "Tai Ji"[Mesh] OR "Yoga"[Mesh] OR "Dance Therapy"[Mesh] OR "Aquatic Therapy"[Mesh] OR exercis*[tiab] OR "physical activity"[tiab] OR "physical activities"[tiab] OR "physical exercise"[tiab] OR "physical exercises"[tiab] OR "physical training"[tiab] OR "exercise training"[tiab] OR "exercise program"[tiab] OR "exercise programs"[tiab] OR "exercise programme"[tiab] OR "exercise programmes"[tiab] OR "aerobic exercise"[tiab] OR "aerobic training"[tiab] OR "endurance exercise"[tiab] OR "endurance training"[tiab] OR "resistance exercise"[tiab] OR "resistance training"[tiab] OR "strength exercise"[tiab] OR "strength training"[tiab] OR "balance exercise"[tiab] OR "balance exercises"[tiab] OR "balance training"[tiab] OR "gait exercise"[tiab] OR "gait training"[tiab] OR "walking exercise"[tiab] OR walking[tiab] OR treadmill[tiab] OR "functional exercise"[tiab] OR "functional training"[tiab] OR "motor training"[tiab] OR "mobility training"[tiab] OR "multicomponent exercise"[tiab] OR "multi-component exercise"[tiab] OR "combined exercise"[tiab] OR "combined training"[tiab] OR "dual task exercise"[tiab] OR "dual-task exercise"[tiab] OR "dual task training"[tiab] OR "dual-task training"[tiab] OR "cognitive motor training"[tiab] OR "cognitive-motor training"[tiab] OR "cognitive physical training"[tiab] OR "cognitive-physical training"[tiab] OR "mind body exercise"[tiab] OR "mind-body exercise"[tiab] OR "tai chi"[tiab] OR taichi[tiab] OR taiji[tiab] OR "tai ji"[tiab] OR qigong[tiab] OR "chi kung"[tiab] OR yoga[tiab] OR dance[tiab] OR dancing[tiab] OR "dance therapy"[tiab] OR exergam*[tiab] OR "active video game"[tiab] OR "active video games"[tiab] OR "virtual reality exercise"[tiab] OR "virtual reality training"[tiab] OR "wii fit"[tiab] OR "Nintendo Wii"[tiab] OR "Ottago exercise"[tiab] OR "aquatic exercise"[tiab] OR "water exercise"[tiab] OR physiotherap*[tiab] OR "physical therapy"[tiab] OR "physical rehabilitation"[tiab] ) AND ( randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR randomised[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab] ) NOT ( animals[mh] NOT humans[mh] )
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Web of Science Core Collection

Search date: 1 July 2026. Coverage: database/platform inception to search date. Yield: 3,156 records.

```
TS=((("mild cognitive impairment" OR "amnesic mild cognitive impairment" OR "mild neurocognitive disorder" OR ((MCI) NEAR/5 (cognit* OR memory OR dementia* OR Alzheimer*)) OR "cognitive impairment" OR "cognitive impairments" OR "cognitively impaired" OR "mild cognitive decline" OR "major neurocognitive disorder*" OR dementia* OR Alzheimer* OR "mild dementia" OR "moderate dementia" OR "mild-to-moderate dementia" OR "mild to moderate dementia" OR "vascular cognitive impairment" OR "vascular dementia" OR "dementia with Lewy bodies" OR "Lewy body dementia" OR "frontotemporal dementia") AND (exercis* OR "exercise therap*" OR "physical activit*" OR "physical exercise*" OR "physical training" OR "exercise training" OR "exercise intervention*" OR "exercise program*" OR "exercise programme*" OR "aerobic exercise*" OR "aerobic training" OR "endurance exercise*" OR "endurance training" OR "resistance exercise*" OR "resistance training" OR "strength exercise*" OR "strength training" OR "progressive resistance training" OR "balance exercise*" OR "balance training" OR "postural training" OR "gait exercise*" OR "gait training" OR "walking exercise*" OR walking OR treadmill* OR cycling OR bicycling OR "functional exercise*" OR "functional training" OR "motor training" OR "mobility training" OR "multicomponent exercise*" OR "multi-component exercise*" OR "multimodal exercise*" OR "multi-modal exercise*" OR "combined exercise*" OR "combined training" OR "dual task exercise*" OR "dual-task exercise*" OR "dual task training" OR "dual-task training" OR "cognitive motor training" OR "cognitive-motor training" OR "physical cognitive training" OR "physical-cognitive training" OR "cognitive physical training" OR "cognitive- physical training" OR "mind body exercise*" OR "mind-body exercise*" OR "tai chi" OR "tai chi chuan" OR taichi OR taiji OR "tai ji" OR qigong OR "chi kung" OR yoga OR dance OR dancing OR "dance therapy" OR "dance movement therapy" OR exergam* OR "active video game*" OR "virtual reality exercise*" OR "virtual reality training" OR "virtual reality rehabilitation" OR "Wii Fit" OR "Nintendo Wii" OR "Otago exercise*" OR "aquatic exercise*" OR "water-based exercise*" OR "water exercise*" OR physiotherap* OR "physical therap*" OR "physical rehabilitation" OR "fall prevention exercise*" OR "falls prevention exercise*" OR "fall prevention program*" OR "falls prevention program*" OR "home-based exercise*" OR "supervised exercise*" AND (random* OR "randomized controlled trial*" OR "randomised controlled trial*" OR "controlled clinical trial*" OR "randomized clinical trial*" OR "randomised clinical trial*" OR "clinical trial*" OR ((controlled OR comparative) NEAR/3 (trial* OR stud*)) OR ((parallel OR cluster) NEAR/3 (trial* OR design* OR group*)) OR placebo* OR allocat* OR assign* OR crossover OR "cross-over" OR "cross over" OR blind* OR mask*))
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Embase

Search date: 1 July 2026. Coverage: database/platform inception to search date. Yield: 12,276 records.

```
('mild cognitive impairment'/exp OR 'dementia'/exp OR 'alzheimer disease'/exp OR ('mild cognitive impairment' OR 'amnesic mild cognitive impairment' OR 'mild neurocognitive disorder' OR 'mild neurocognitive disorders' OR 'major neurocognitive disorder' OR 'major neurocognitive disorders' OR 'cognitive impairment' OR 'cognitive impairments' OR 'cognitively impaired' OR 'cognitive decline' OR dementia* OR alzheimer* OR 'mild dementia' OR 'moderate dementia' OR 'mild to moderate dementia' OR 'mild-to-moderate dementia' OR 'early dementia' OR 'early stage dementia' OR 'early-stage dementia' OR 'vascular cognitive impairment' OR 'vascular dementia' OR 'dementia with lewy bodies' OR 'lewy body dementia' OR 'frontotemporal dementia'):ti,ab,kw OR (MCI NEAR/5 (cognit* OR memory OR dementia* OR alzheimer*)):ti,ab,kw) AND ('exercise'/exp OR 'kinesiotherapy'/exp OR 'physical activity'/exp OR 'physiotherapy'/exp OR 'walking'/exp OR (exercis* OR kinesiotherap* OR physiotherap* OR 'exercise therapy' OR 'physical activity' OR 'physical activities' OR 'physical exercise' OR 'physical exercises' OR 'physical training' OR 'exercise training' OR 'exercise intervention' OR 'exercise interventions' OR 'exercise program' OR 'exercise programs' OR 'exercise programme' OR 'exercise programmes' OR 'aerobic exercise' OR 'aerobic exercises' OR 'aerobic training' OR 'endurance exercise' OR 'endurance training' OR 'resistance exercise' OR 'resistance exercises' OR 'resistance training' OR 'strength exercise' OR 'strength exercises' OR 'strength training' OR 'progressive resistance training' OR 'balance exercise' OR 'balance exercises' OR 'balance training' OR 'postural training' OR 'gait exercise' OR 'gait exercises' OR 'gait training' OR 'walking exercise' OR 'walking exercises' OR 'walking training' OR treadmill* OR cycling OR bicycling OR 'functional exercise' OR 'functional exercises' OR 'functional training' OR 'motor training' OR 'mobility training' OR 'multicomponent exercise' OR 'multi-component exercise' OR 'multimodal exercise' OR 'multi-modal exercise' OR 'combined exercise' OR 'combined training' OR 'dual task exercise' OR 'dual-task exercise' OR 'dual task training' OR 'dual-task training' OR 'cognitive motor training' OR 'cognitive-motor training' OR 'physical cognitive training' OR 'physical-cognitive training' OR 'cognitive physical training' OR 'cognitive-physical training' OR 'mind body exercise' OR 'mind-body exercise' OR 'tai chi' OR 'tai chi chuan' OR taichi OR taiji OR 'tai ji' OR qigong OR 'chi kung' OR baduanjin OR wuqinxi OR yoga OR dance OR dancing OR 'dance therapy' OR 'dance movement therapy' OR exergam* OR 'active video game' OR 'active video games' OR 'virtual reality exercise' OR 'virtual reality training' OR 'virtual reality rehabilitation' OR 'wii fit' OR 'nintendo wii' OR 'otago exercise' OR 'aquatic exercise' OR 'aquatic exercises' OR 'water exercise' OR 'water exercises' OR 'water based exercise' OR 'water-based exercise' OR 'whole body vibration' OR 'whole-body vibration' OR 'vibration training' OR 'square stepping' OR 'square stepping exercise' OR 'home based exercise' OR 'home-based exercise' OR 'supervised exercise' OR 'fall prevention exercise' OR 'falls prevention exercise' OR 'fall prevention program' OR 'fall prevention programs' OR 'fall prevention programme' OR 'fall prevention programmes'):ti,ab,kw) AND (('randomized controlled trial'/exp OR 'controlled clinical trial'/de OR random*:ti,ab,tt OR 'randomization'/de OR 'intermethod comparison'/de OR placebo:ti,ab,tt OR compare:ti,tt OR compared:ti,tt OR comparison:ti,tt OR ((evaluated:ab OR evaluate:ab OR evaluating:ab OR assessed:ab OR assess:ab) AND (compare:ab OR compared:ab OR comparing:ab OR comparison:ab)) OR (open NEXT/1 label):ti,ab,tt OR ((double OR single OR doubly OR singly) NEXT/1 (blind OR blinded OR blindly)):ti,ab,tt OR 'double blind procedure'/de OR (parallel NEXT/1 group*):ti,ab,tt OR crossover:ti,ab,tt OR 'cross over':ti,ab,tt OR ((assign* OR match OR matched OR allocation) NEAR/6 (alternate OR group OR groups OR intervention OR interventions OR patient OR patients OR subject OR subjects OR participant OR participants)):ti,ab,tt OR assigned:ti,ab,tt OR allocated:ti,ab,tt OR (controlled NEAR/8 (study OR design OR trial)):ti,ab,tt OR volunteer:ti,ab,tt OR volunteers:ti,ab,tt OR 'human experiment'/de OR trial:ti,tt) NOT (((random* NEXT/1 sampl* NEAR/8 ('cross section*' OR questionnaire* OR survey OR surveys OR database OR databases)):ti,ab,tt) NOT ('comparative study'/de OR 'controlled study'/de OR 'randomised controlled':ti,ab,tt OR 'randomized controlled':ti,ab,tt OR 'randomly assigned':ti,ab,tt)) OR ('cross-sectional study'/de NOT ('randomized controlled trial'/exp OR 'controlled clinical trial'/de OR 'controlled study'/de OR 'randomised controlled':ti,ab,tt OR 'randomized
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controlled':ti,ab,tt OR 'control group':ti,ab,tt OR 'control groups':ti,ab,tt)) OR ('case
control*':ti,ab,tt AND random*:ti,ab,tt NOT ('randomised controlled':ti,ab,tt OR 'randomized
controlled':ti,ab,tt)) OR ('systematic review':ti,tt NOT (trial:ti,tt OR study:ti,tt)) OR
(nonrandom*:ti,ab,tt NOT random*:ti,ab,tt) OR 'random field*':ti,ab,tt OR ('random cluster' NEAR/4
saml*):ti,ab,tt OR (review:ab AND review:it NOT trial:ti,tt) OR ('we searched':ab AND (review:ti,tt OR
review:it)) OR 'update review':ab OR (databases NEAR/5 searched):ab OR ((rat:ti,tt OR rats:ti,tt OR
mouse:ti,tt OR mice:ti,tt OR swine:ti,tt OR porcine:ti,tt OR murine:ti,tt OR sheep:ti,tt OR lambs:ti,tt OR
pigs:ti,tt OR piglets:ti,tt OR rabbit:ti,tt OR rabbits:ti,tt OR cat:ti,tt OR cats:ti,tt OR dog:ti,tt OR
dogs:ti,tt OR cattle:ti,tt OR bovine:ti,tt OR monkey:ti,tt OR monkeys:ti,tt OR trout:ti,tt OR
marmoset*:ti,tt) AND 'animal experiment'/de) OR ('animal experiment'/de NOT ('human experiment'/de OR
'human'/de)))
```

Cochrane Library

Search date: 1 July 2026. Coverage: database/platform inception to search date. Yield: 338 records.

```
"mild cognitive impairment"
"cognitive impairment"
dementia
Alzheimer
#1 OR #2 OR #3 OR #4
Exercise
"physical activity"
"exercise therapy"
"aerobic exercise"
"resistance training"
"balance training"
"gait training"
"walking training"
"dual task training"
"multicomponent exercise"
"tai chi"
qigong
dance
exergaming
"virtual reality training"
"whole body vibration"
"home based exercise"
#6 OR #7 OR #8 OR #9 OR #10 OR #11
#12 OR #13 OR #14 OR #15 OR #16 OR #17
#18 OR #19 OR #20 OR #21 OR #22 OR #23
#24 OR #25 OR #26
#5 AND #27
```

Scopus

Search date: 1 July 2026. Coverage: database/platform inception to search date. Yield: 6,225 records.

```
TITLE-ABS-KEY(("mild cognitive impairment" OR "amnesic mild cognitive impairment" OR "mild neurocognitive
disorder" OR "mild neurocognitive disorders" OR "cognitive impairment" OR "cognitive impairments" OR
"cognitively impaired" OR "cognitive decline" OR dementia* OR alzheimer* OR "mild dementia" OR "moderate
dementia" OR "mild to moderate dementia" OR "mild-to-moderate dementia" OR "early dementia" OR "vascular
cognitive impairment" OR "vascular dementia" OR "dementia with lewy bodies" OR "lewy body dementia" OR
"frontotemporal dementia" OR (MCI W/5 cognit*) OR (MCI W/5 memory) OR (MCI W/5 dementia*) OR (MCI W/5
alzheimer*)) AND (exercis* OR "exercise therapy" OR "physical activity" OR "physical exercise" OR "physical
training" OR "exercise training" OR "exercise intervention" OR "exercise interventions" OR "exercise
program" OR "exercise programs" OR "exercise programme" OR "exercise programmes" OR "aerobic exercise" OR
"aerobic training" OR "endurance exercise" OR "endurance training" OR "resistance exercise" OR "resistance
training" OR "strength exercise" OR "strength training" OR "progressive resistance training" OR "balance
exercise" OR "balance exercises" OR "balance training" OR "postural training" OR "gait training" OR
"walking training" OR "functional exercise" OR "functional training" OR "mobility training" OR
"multicomponent exercise" OR "multi-component exercise" OR "multimodal exercise" OR "multi-modal exercise"
OR "combined exercise" OR "combined training" OR "dual task exercise" OR "dual-task exercise" OR "dual task
training" OR "dual-task training" OR "cognitive motor training" OR "cognitive-motor training" OR "physical
cognitive training" OR "physical-cognitive training" OR "cognitive physical training" OR "cognitive-
physical training" OR "mind body exercise" OR "mind-body exercise" OR "tai chi" OR "tai chi chuan" OR
taichi OR taiji OR qigong OR yoga OR dance OR dancing OR "dance therapy" OR exergam* OR "active video game"
OR "active video games" OR "virtual reality exercise" OR "virtual reality training" OR "wii fit" OR
"nintendo wii" OR "whole body vibration" OR "whole-body vibration" OR "aquatic exercise" OR "home based
exercise" OR "home-based exercise" OR "fall prevention exercise" OR "falls prevention exercise" OR "fall
prevention program" OR "fall prevention programs" OR "fall prevention programme" OR "falls prevention
programmes") AND (random* OR "randomized controlled trial" OR "randomised controlled trial" OR "randomized
clinical trial" OR "randomised clinical trial" OR "controlled clinical trial" OR "controlled trial" OR
placebo* OR "parallel group" OR "parallel-group" OR "cluster randomized" OR "cluster randomised" OR
(allocat* W/5 group*) OR (assign* W/5 group*) OR blind* OR mask* OR "wait list" OR "wait-list" OR "waiting
list" OR waitlist*))
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Wiley Online Library

Search date: 1 July 2026. Coverage: database/platform inception to search date. Yield: 1,321 records.

```
((("mild cognitive impairment" OR "amnesic mild cognitive impairment" OR "mild neurocognitive disorder" OR "mild neurocognitive disorders" OR "cognitive impairment" OR "cognitive impairments" OR "cognitively impaired" OR "cognitive decline" OR dementia* OR Alzheimer* OR "mild dementia" OR "moderate dementia" OR "mild to moderate dementia" OR "mild-to-moderate dementia" OR "early dementia" OR "vascular cognitive impairment" OR "vascular dementia" OR "dementia with Lewy bodies" OR "Lewy body dementia" OR "frontotemporal dementia") AND (exercis* OR "exercise therapy" OR "physical activity" OR "physical exercise" OR "physical training" OR "exercise training" OR "exercise intervention" OR "exercise interventions" OR "exercise program" OR "exercise programs" OR "exercise programme" OR "exercise programmes" OR "aerobic exercise" OR "aerobic training" OR "resistance exercise" OR "resistance training" OR "strength exercise" OR "strength training" OR "balance exercise" OR "balance training" OR "postural training" OR "gait training" OR "walking training" OR "functional training" OR "mobility training" OR "multicomponent exercise" OR "multi-component exercise" OR "multimodal exercise" OR "combined exercise" OR "dual task exercise" OR "dual-task exercise" OR "dual task training" OR "dual-task training" OR "cognitive motor training" OR "cognitive-motor training" OR "mind body exercise" OR "mind-body exercise" OR "Tai Chi" OR "Tai Chi Chuan" OR taichi OR taiji OR qigong OR yoga OR dance OR dancing OR exergam* OR "active video game" OR "active video games" OR "virtual reality exercise" OR "virtual reality training" OR "Wii Fit" OR "Nintendo Wii" OR "whole body vibration" OR "whole-body vibration" OR "aquatic exercise" OR "home based exercise" OR "home-based exercise" OR "fall prevention exercise" OR "falls prevention exercise") AND ("fear of falling" OR "fear of falls" OR "concern about falling" OR "concerns about falling" OR "concern over falling" OR "concerns over falling" OR "balance confidence" OR "activities- specific balance confidence" OR "activities specific balance confidence" OR "ABC scale" OR "falls efficacy" OR "fall efficacy" OR "falls efficacy scale" OR "fall efficacy scale" OR "FES-I" OR "Short FES-I" OR iconFES OR "iconographical falls efficacy scale" OR "modified falls efficacy scale" OR MFES OR "Tinetti falls efficacy scale") AND (random* OR trial* OR placebo* OR "randomized controlled trial" OR "randomised controlled trial" OR "randomized clinical trial" OR "randomised clinical trial" OR "controlled clinical trial" OR "controlled trial" OR "wait list" OR "wait-list" OR waitlist*))
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CINAHL

Search date: 1 July 2026. Coverage: database/platform inception to search date. Yield: 2,251 records.

```
((MH "Mild Cognitive Impairment" OR MH "Dementia+" OR MH "Alzheimer's Disease+" OR TI ("mild cognitive impairment" OR "amnesic mild cognitive impairment" OR "mild neurocognitive disorder" OR "mild neurocognitive disorders" OR "major neurocognitive disorder" OR "major neurocognitive disorders" OR "cognitive impairment" OR "cognitive impairments" OR "cognitively impaired" OR "cognitive decline" OR dementia* OR Alzheimer* OR "mild dementia" OR "moderate dementia" OR "mild to moderate dementia" OR "mild-to-moderate dementia" OR "early dementia" OR "early stage dementia" OR "early-stage dementia" OR "vascular cognitive impairment" OR "vascular dementia" OR "dementia with Lewy bodies" OR "Lewy body dementia" OR "frontotemporal dementia") OR AB ("mild cognitive impairment" OR "amnesic mild cognitive impairment" OR "mild neurocognitive disorder" OR "mild neurocognitive disorders" OR "major neurocognitive disorder" OR "major neurocognitive disorders" OR "cognitive impairment" OR "cognitive impairments" OR "cognitively impaired" OR "cognitive decline" OR dementia* OR Alzheimer* OR "mild dementia" OR "moderate dementia" OR "mild to moderate dementia" OR "mild-to-moderate dementia" OR "early stage dementia" OR "early stage dementia" OR "early-stage dementia" OR "vascular cognitive impairment" OR "vascular dementia" OR "dementia with Lewy bodies" OR "Lewy body dementia" OR "frontotemporal dementia") OR TI (MCI N5 cognit*) OR TI (MCI N5 memory) OR TI (MCI N5 dementia*) OR TI (MCI N5 Alzheimer*) OR AB (MCI N5 cognit*) OR AB (MCI N5 memory) OR AB (MCI N5 dementia*) OR AB (MCI N5 Alzheimer*)) AND (MH "Exercise+" OR MH "Therapeutic Exercise+" OR MH "Physical Activity+" OR TI (exercis* OR kinesiotherap* OR physiotherap* OR "exercise therapy" OR "physical activity" OR "physical activities" OR "physical exercise" OR "physical exercises" OR "physical training" OR "exercise training" OR "exercise intervention" OR "exercise interventions" OR "exercise program" OR "exercise programs" OR "exercise programme" OR "exercise programmes" OR "aerobic exercise" OR "aerobic exercises" OR "aerobic training" OR "endurance exercise" OR "endurance training" OR "resistance exercise" OR "resistance exercises" OR "resistance training" OR "strength exercise" OR "strength exercises" OR "strength training" OR "progressive resistance training" OR "balance exercise" OR "balance exercises" OR "balance training" OR "postural training" OR "gait exercise" OR "gait exercises" OR "gait training" OR "walking exercise" OR "walking exercises" OR "walking training" OR treadmill* OR cycling OR bicycling OR "functional exercise" OR "functional exercises" OR "functional training" OR "motor training" OR "mobility training" OR "multicomponent exercise" OR "multi-component exercise" OR "multimodal exercise" OR "multi-modal exercise" OR "combined exercise" OR "combined training" OR "dual task exercise" OR "dual-task exercise" OR "dual task training" OR "dual-task training" OR "cognitive motor training" OR "cognitive-motor training" OR "physical cognitive training" OR "physical-cognitive training" OR "cognitive physical training" OR "cognitive-physical training" OR "mind body exercise" OR "mind-body exercise" OR "Tai Chi" OR "Tai Chi Chuan" OR taichi OR taiji OR "Tai Ji" OR qigong OR "chi kung" OR baduanjin OR wuqinxi OR yoga OR dance OR dancing OR "dance therapy" OR "dance movement therapy" OR exergam* OR "active video game" OR "active video games" OR "virtual reality exercise" OR "virtual reality training" OR "virtual reality rehabilitation" OR "Wii Fit" OR "Nintendo Wii" OR "Otago exercise" OR "aquatic exercise" OR "aquatic exercises" OR "water exercise" OR "water exercises" OR "water based exercise" OR "water-based exercise" OR "whole body vibration" OR "whole-body vibration" OR "vibration training" OR "square stepping" OR "square stepping exercise" OR "home based exercise" OR "home-based exercise" OR "supervised exercise" OR "fall prevention exercise" OR "falls prevention exercise" OR "fall prevention program" OR "fall prevention programs" OR "fall prevention programme" OR "fall prevention programmes") OR AB (exercis* OR kinesiotherap* OR physiotherap* OR "exercise therapy" OR "physical activity" OR "physical activities" OR "physical exercise" OR "physical exercises" OR "physical training" OR "exercise training" OR "exercise intervention" OR "exercise interventions" OR "exercise program" OR "exercise programs" OR "exercise programme" OR "exercise programmes" OR "aerobic exercise" OR "aerobic exercises" OR "aerobic training" OR "endurance exercise" OR "endurance training" OR "resistance exercise" OR "resistance exercises" OR "resistance training" OR "strength exercise" OR "strength exercises" OR "strength training" OR "progressive resistance training" OR "balance exercise" OR "balance exercises" OR "balance training" OR "postural training" OR "gait exercise" OR "gait exercises" OR "gait training" OR "walking exercise" OR "walking exercises" OR "walking training" OR treadmill* OR cycling OR bicycling OR "functional exercise" OR "functional exercises" OR "functional training" OR "motor
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training" OR "mobility training" OR "multicomponent exercise" OR "multi-component exercise" OR "multimodal exercise" OR "multi-modal exercise" OR "combined exercise" OR "combined training" OR "dual task exercise" OR "dual-task exercise" OR "dual task training" OR "dual-task training" OR "cognitive motor training" OR "cognitive-motor training" OR "physical cognitive training" OR "physical-cognitive training" OR "cognitive physical training" OR "cognitive-physical training" OR "mind body exercise" OR "mind-body exercise" OR "Tai Chi" OR "Tai Chi Chuan" OR taichi OR taiji OR "Tai Ji" OR qigong OR "chi kung" OR baduanjin OR wuqinxi OR yoga OR dance OR dancing OR "dance therapy" OR "dance movement therapy" OR exergam* OR "active video game" OR "active video games" OR "virtual reality exercise" OR "virtual reality training" OR "virtual reality rehabilitation" OR "Wii Fit" OR "Nintendo Wii" OR "Otago exercise" OR "aquatic exercise" OR "aquatic exercises" OR "water exercise" OR "water exercises" OR "water based exercise" OR "water-based exercise" OR "whole body vibration" OR "whole-body vibration" OR "vibration training" OR "square stepping" OR "square stepping exercise" OR "home based exercise" OR "home-based exercise" OR "supervised exercise" OR "fall prevention exercise" OR "falls prevention exercise" OR "fall prevention program" OR "fall prevention programs" OR "fall prevention programme" OR "fall prevention programmes")) AND ((MH "Randomized Controlled Trials+" OR MH "Double-Blind Studies" OR MH "Single-Blind Studies" OR MH "Random Assignment" OR MH "Pretest-Posttest Design" OR MH "Cluster Sample" OR TI (randomised OR randomized) OR AB random* OR TI trial OR (MH "Sample Size" AND AB (assigned OR allocated OR control)) OR MH "Placebos" OR PT "Randomized Controlled Trial" OR AB (control W5 group) OR MH "Crossover Design" OR MH "Comparative Studies" OR AB (cluster W3 RCT)) NOT ((MH "Animals+" OR MH "Animal Studies" OR TI (animal model*)) NOT MH "Human")))

Supplementary Methods: Construct mapping, primary-effect selection, and data-processing rules

Supplementary Table S2. Prespecified construct framework

Construct	Eligible instruments	Original score interpretation	Primary effect measure	Analysis direction
Balance confidence	Activities-specific Balance Confidence Scale (ABC) and validated versions	0-100; higher scores indicate greater confidence	Mean difference (MD)	Positive values favour exercise
Concerns about falling	FES-I, Short FES-I, iconFES/Short iconFES	Higher scores indicate greater concerns	Hedges' g	Original direction reversed; positive values favour exercise
Traditional falls efficacy	Original FES, MFES, Tinetti FES	Instrument-specific; original FES in Padala had lower scores indicating better efficacy	MD or narrative effect	Direction reversed where required; positive values favour exercise

Note: Outcomes were not pooled across constructs. ABC outcomes were analysed on a common 0-100 scale. FES-I-family effects were directionally reversed so that positive values favoured exercise.

Supplementary Table S3. Trial-level primary-effect selection and effect estimates

Study	Construct	Primary time point	Instrument	Primary-effect source	Effect	95% CI	Weight/role
Cámara-Calmaestra et al. (2025)	Balance confidence	12 weeks	ABC	Derived between-group MD from eligible group-level data	5.50	-4.04 to 15.04	7.9%
Padala et al. (2017)	Balance confidence	8 weeks	ABC	Author-reported between-group effect	6.50	3.60 to 9.40	21.2%
Hwang et al. (2023)	Balance confidence	6 months	ABC	Author-reported adjusted group $\times$ time MD; TCE vs HE only	8.30	4.80 to 11.80	19.6%
Lam et al. (2018)	Balance confidence	9 weeks	ABC	Change-score MD with uncertainty derived from the original report	2.20	-6.80 to 11.20	8.6%
Lü et al. (2016)	Balance confidence	12 weeks	ABC	Change-score MD; SE derived from reported CI	-1.91	-5.85 to 2.03	18.5%
Uysal et al. (2023)	Balance confidence	12 weeks	ABC	AG, DG and ADG combined before comparison with shared CG	3.89	2.40 to 5.37	24.2%
Chen et al. (2018)	Concerns about falling	~1 week after 8-week training	FES-I	Change-score Hedges' g; direction harmonised	0.40	-0.38 to 1.18	8.9%
Harwood et al. (2023)	Concerns about falling	12 months	Short FES-I	Adjusted Cohen d converted to Hedges' g; multiple-imputation estimate	-0.02	-0.26 to 0.22	56.4%
Nyman et al. (2019)	Concerns about falling	6 months	iconFES	Endpoint Hedges' g; direction harmonised	0.13	-0.34 to 0.60	21.7%
Schwenk et al. (2016)	Concerns about falling	4 weeks	Short FES-I	Endpoint Hedges' g; complete-case data	1.09	0.14 to 2.05	6.1%
Wesson et al. (2013)	Concerns about falling	12 weeks	Short FES-I	Endpoint Hedges' g; iconFES retained as alternative scale	0.27	-0.61 to 1.16	7.0%
Padala et al. (2017)	Traditional falls efficacy	8 weeks	Original FES	Author-reported MD; direction reversed	4.80	2.00 to 7.60	Not pooled

Note: Each Trial_ID contributed a maximum of one primary effect per construct. Random-effects weights are shown for pooled models; the traditional FES result was not pooled.

Effect-source hierarchy

- Author-reported adjusted between-group effects consistent with the estimand were prioritised.
- If no eligible adjusted effect was available, between-group change effects were preferred, followed by follow-up endpoint effects.
- Intention-to-treat or multiple-imputation analyses were preferred where available.
- Outcome-specific sample sizes were used rather than total randomised sample sizes.
- Repeated time points, alternative instruments, and alternative estimators from the same Trial_ID were reserved for sensitivity or supportive analyses.

Core calculations and data transformations

- SE derived from a symmetric 95% confidence interval: $SE = (\text{upper limit} - \text{lower limit}) / 3.92$; sampling variance $v = SE^2$.
- Hedges' g: Cohen d was multiplied by the small-sample correction $J = 1 - 3/(4df - 1)$.
- Combined intervention arms: $n_{\text{comb}} = \sum n_j$; $Mean_{\text{comb}} = \sum (n_j \times Mean_j) / \sum n_j$; the combined SD included both within-arm and between-arm components.
- Direction harmonisation: ABC effects retained their original sign; FES-I-family and original FES effects were multiplied by -1 where required so that positive values favoured exercise.
- Primary random-effects models used inverse-variance weighting, restricted maximum likelihood (REML) estimation of τ^2 , and modified Knapp-Hartung inference with an ad hoc safeguard against anomalously narrow intervals.

Supplementary Data: Extracted arm-level outcome data

Supplementary Table S4. Extracted group-level data and role in the analysis

Study/ comparison	Construct	Instrument	Time point	Data type	E mean	E SD	E n	C mean	C SD	C n	Analysis role	Audit note
Cámara-Calmaestra et al. (2025)	Balance confidence	ABC	12 weeks	Endpoint	60.1	17.6	30	51.8	20.5	30	Primary-supporting data	T2 endpoint values
Padala et al. (2017)	Balance confidence	ABC	8 weeks	Change	5.6	3.623	12	-0.9	3.623	12	Primary	Change SD derived from 95% CI
Chen et al. (2018)	Concerns about falling	FES-I	~1 week after training	Change	-0.3	9.163	14	2.9	5.656	12	Primary	Lower raw scores favour intervention; effect direction reversed
Harwood et al. (2023)	Concerns about falling	Short FES-I	12 months	Endpoint	11	4.5	138	10.9	4.8	134	Supporting raw data	Primary model used author-adjusted standardised effect
Hwang et al. (2023)	Balance confidence	ABC	12 months	Change	20	10.3	35	8.8	8.3	49	Alternative time point	Primary model used author-adjusted 6-month effect; only TCE vs HE eligible
Lam et al. (2018)	Balance confidence	ABC	9 weeks	Change	0.4	17.365	27	-1.8	16.13	26	Primary	SD derived from reported CI; original table inconsistency retained in audit trail
Lù et al. (2016)	Balance confidence	ABC	12 weeks	Change	-0.95	8.22	22	0.96	4.735	23	Primary	SD derived from reported CI
Nyman et al. (2019)	Concerns about falling	iconFES	6 months	Endpoint	17.3	6.3	36	18.2	7.2	34	Primary	Lower raw scores favour intervention; effect direction reversed
Schwenk et al. (2016)	Concerns about falling	Short FES-I	4 weeks	Endpoint	8.2	1.4	11	9.8	1.4	9	Primary	Lower raw scores favour intervention; complete-case data
Uysal et al. (2023), AG vs CG	Balance confidence	ABC	12 weeks	Change	4.01	2.66	12	1.15	1.99	12	Constituent arm	Combined with DG and ADG before the primary comparison
Uysal et al. (2023), DG vs CG	Balance confidence	ABC	12 weeks	Change	5.42	3.75	12	1.15	1.99	12	Constituent arm	Combined with AG and ADG before the primary comparison
Uysal et al. (2023), ADG vs CG	Balance confidence	ABC	12 weeks	Change	5.68	2.19	12	1.15	1.99	12	Constituent arm	Combined with AG and DG before the primary comparison
Wesson et al. (2013)	Concerns about falling	Short FES-I	12 weeks	Endpoint	8.2	1.9	9	9.4	5.4	11	Primary	Lower raw scores favour

Study/ comparison	Construct	Instrument	Time point	Data type	E mean	E SD	E n	C mean	C SD	C n	Analysis role	Audit note
												intervention
Wesson et al. (2013)	Concerns about falling	iconFES	12 weeks	Endpoint	47.3	18.5	8	44.6	12.8	9	Alternative scale	Used only in sensitivity/supporti ve analyses

Note: E, exercise intervention; C, comparator. This table is an audit trail of extracted arm-level values. Where an author-reported adjusted effect was preferred, the arm-level values shown here were supporting rather than primary inputs. Values reconstructed from confidence intervals are explicitly labelled.

Multi-arm combination for Uysal et al. (2023)

The three eligible exercise arms (AG, DG, and ADG) were combined before comparison with the shared control group. Combined exercise n = 36, mean change = 5.037, SD = 2.950; control n = 12, mean change = 1.150, SD = 1.990. The resulting mean difference was 3.89 points (95% CI 2.40 to 5.37).

Supplementary Data: Sensitivity and influence analyses

Supplementary Table S5. Sensitivity analyses for balance confidence

Analysis ID	Model or data change	MD	95% CI	Interpretation
Primary model	REML + modified Knapp-Hartung	4.22	-0.03 to 8.46	Primary inference
S1	Wald CI instead of modified Knapp-Hartung	4.22	0.98 to 7.45	Narrower interval; direction unchanged
S2	Paule-Mandel instead of REML	4.24	0.29 to 8.18	$\tau^2 = 8.77$
Diagnostic	Fixed-effect model	4.28	3.12 to 5.44	Diagnostic only
S5	Cámara-Calmaestra 24-week follow-up	4.67	-0.59 to 9.93	Alternative time point
S5	Padala 16-week follow-up	3.08	-2.70 to 8.87	Alternative time point
S5	Hwang 12-month follow-up	3.39	-1.76 to 8.54	Alternative time point
S5	Lam 21-week follow-up	4.78	-1.33 to 10.89	Alternative time point
S6	Uysal AG arm only	5.00	-0.24 to 10.24	Shared-control sensitivity
S6	Uysal DG arm only	5.32	-0.07 to 10.71	Shared-control sensitivity
S6	Uysal ADG arm only	5.52	-0.17 to 11.21	Shared-control sensitivity
S4	Exclude clearly multicomponent interventions	4.38	-9.03 to 17.80	Only three trials remained
S10	Multilevel model, $\rho = 0.3$	5.29	4.07 to 6.51	Supportive analysis
S10	Multilevel model, $\rho = 0.5$	5.31	4.07 to 6.55	Supportive analysis
S10	Multilevel model, $\rho = 0.7$	5.48	4.30 to 6.67	Supportive analysis
S3	Exclude outcomes at overall high risk of bias	3.60	-1.95 to 9.14	Direction unchanged; precision reduced

Note: Positive MD values favour exercise. The primary estimate was MD 4.22 (95% CI -0.03 to 8.46).

Supplementary Table S6. Sensitivity analyses for concerns about falling

Analysis ID	Model or data change	Hedges' g	95% CI	Interpretation
Primary model	REML + modified Knapp-Hartung	0.17	-0.18 to 0.51	Primary inference
S1	Wald CI instead of modified Knapp-Hartung	0.17	-0.06 to 0.40	Conclusion unchanged
S2	Paule-Mandel instead of REML	0.20	-0.18 to 0.58	$\tau^2 = 0.025$
Diagnostic	Fixed-effect model	0.12	-0.05 to 0.30	Diagnostic only
S4	Exclude PRAISED multicomponent intervention	0.34	-0.25 to 0.92	Four trials remained
Comparator restriction	Exclude active comparator	0.13	-0.29 to 0.55	Conclusion unchanged
S9	Wesson iconFES replaces Short FES-I	0.11	-0.18 to 0.39	Alternative scale
S10	Multilevel model, $\rho = 0.3$	0.06	-0.09 to 0.21	Supportive analysis
S10	Multilevel model, $\rho = 0.5$	0.07	-0.09 to 0.23	Supportive analysis
S10	Multilevel model, $\rho = 0.7$	0.08	-0.09 to 0.25	Supportive analysis
S3	Exclude outcomes at overall high risk of bias	0.07	-0.33 to 0.47	Conclusion unchanged; precision reduced

Note: Positive Hedges' g values favour exercise after harmonisation of score direction. All sensitivity intervals shown crossed the null except where otherwise apparent.

Supplementary Table S7. Leave-one-out and influence diagnostics

Construct	Diagnostic analysis	Effect/range	Heterogeneity or diagnostic finding	Decision
Balance confidence	All leave-one-out models	3.24 to 5.56	All pooled MDs remained positive	Direction preserved
Balance confidence	Exclude Lü et al. (2016)	5.56 (2.39 to 8.74)	τ^2 10.69 → 2.67; I^2 71.2% → 42.4%	Major contributor to heterogeneity; retained because no data or eligibility error was

Construct	Diagnostic analysis	Effect/range	Heterogeneity or diagnostic finding	Decision
				identified
Balance confidence	Exclude Hwang et al. (2023)	3.24 (-1.54 to 8.01)	Lowest leave-one-out point estimate	Conclusion remained uncertain
Concerns about falling	All leave-one-out models	0.09 to 0.34	All 95% CIs crossed the null	Conclusion stable
Concerns about falling	Exclude Schwenk et al. (2016)	Not separately reported	τ^2 approached 0; $I^2 = 0\%$	Contributor to heterogeneity; retained
Concerns about falling	Exclude Harwood et al. (2023)	0.34 (-0.25 to 0.92)	Largest leave-one-out point estimate	Conclusion unchanged

Note: No study was removed solely because it was influential. All eligible trials were retained unless a data error or protocol-defined eligibility problem was identified.

Analyses not undertaken

- Formal meta-regression and inferential tests of subgroup differences were not undertaken because each primary construct included fewer than 10 independent trials.
- Egger regression, trim-and-fill, and inferential funnel-plot analyses were not undertaken because each primary outcome included fewer than 10 trials.
- A random-effects summary restricted to inactive or attention controls was not produced for balance confidence because only two eligible trials remained.

Supplementary Methods: Outcome-specific risk of bias and certainty of evidence

Supplementary Table S8. Outcome-specific RoB 2 judgements

Study/outcome	D1 Randomisation	D2 Deviations	D3 Missing data	D4 Measurement	D5 Selective reporting	Overall
Cámara-Calmaestra et al. (2025)	Some concerns	Low risk	Low risk	Some concerns	Some concerns	Some concerns
Padala et al. (2017)	Some concerns	Some concerns	Some concerns	High risk	Some concerns	High risk
Chen et al. (2018)	Some concerns	Some concerns	Some concerns	High risk	Some concerns	High risk
Harwood et al. (2023)	Low risk	Low risk	Low risk	Some concerns	Low risk	Some concerns
Hwang et al. (2023), TCE vs HE	Some concerns	Low risk	Some concerns	Some concerns	Some concerns	Some concerns
Lam et al. (2018)	Low risk	Low risk	Low risk	Some concerns	Some concerns	Some concerns
Lü et al. (2016)	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns
Nyman et al. (2019)	Low risk	Low risk	Some concerns	Some concerns	Low risk	Some concerns
Schwenk et al. (2016)	Some concerns	Low risk	Low risk	High risk	Some concerns	High risk
Uysal et al. (2023)	Some concerns	Some concerns	Low risk	Some concerns	Some concerns	Some concerns
Wesson et al. (2013)	Low risk	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns

Note: D1, bias arising from the randomisation process; D2, bias due to deviations from intended interventions; D3, bias due to missing outcome data; D4, bias in measurement of the outcome; D5, bias in selection of the reported result. Judgements refer to the target outcome used in this review.

Supplementary Table S9. GRADE evidence profile

Outcome	Evidence base	Effect estimate	Risk of bias	Inconsistency	Indirectness	Imprecision	Missing evidence	Certainty
Balance confidence (ABC, 0-100)	6 RCTs; N = 327	MD 4.22 higher (95% CI -0.03 to 8.46); 95% PI -5.20 to 13.63	Serious	Serious	Not serious	Serious	Not strongly suspected	Very low (⊕○○○)
Concerns about falling (FES-I family)	5 RCTs; N = 501	Hedges' g 0.17 (95% CI -0.18 to 0.51); 95% PI -0.29 to 0.63	Serious	Not serious	Not serious	Serious	Not strongly suspected	Low (⊕⊕○○)
Traditional falls efficacy (original FES)	1 RCT; N = 30	8-week MD 4.80 (95% CI 2.00 to 7.60); supportive 16-week MD 2.20 (-0.70 to 5.10)	Very serious	Not assessed	Not serious	Serious	Not strongly suspected	Very low (⊕○○○)

Note: Balance confidence was downgraded for risk of bias, inconsistency, and imprecision. Concerns about falling was downgraded for risk of bias and imprecision. Traditional falls efficacy was downgraded two levels for risk of bias and one level for imprecision.

Supplementary Note: Protocol amendments and reproducibility notes

Supplementary Table S10. Substantive amendments documented before formal meta-analysis

Domain	Earlier plan	Version 2.0 decision	Reason
Scope	Earlier plan included activity avoidance	Quantitative synthesis restricted to balance confidence and concerns about falling; traditional FES narratively assessed	No combinable activity-avoidance evidence in the final 11 trials
Primary model	Multilevel meta-analysis was initially considered as primary	One primary effect per Trial_ID in a two-level random-effects model became primary	Only 5-6 independent trials per construct; multilevel inference was unstable
Multilevel model	Primary analysis	Supportive analysis only	Used to retain repeated time points/scales without driving primary inference
Traditional FES	Separate pooled model planned	Single-trial narrative synthesis	Only Padala et al. contributed eligible data
Change-score SD	Default $r = 0.50$ permitted	No primary effect used $r = 0.50$ imputation; correlation assumptions used only for supportive dependence models	Direct, adjusted, or CI-derived effects were available
Meta-regression	Multiple moderators planned	No formal meta-regression; descriptive interpretation only	Independent trial count below the prespecified threshold

Note: SAP Version 2.0 was finalised after study identification and data extraction but before formal meta-analysis. It should not be described as a fully prospective analysis plan.

Reproducibility specifications

- Primary analyses were specified for R version 4.5.2 using metafor-compatible random-effects and multilevel models.
- The primary analysis unit was Trial_ID. Effect_IDs were nested within Trial_ID only in supportive multilevel models.
- Primary models used REML estimation and modified Knapp-Hartung inference; Wald and Paule-Mandel results were sensitivity analyses.
- The frozen analysis dataset, transformation audit trail, risk-of-bias judgements, and GRADE ratings were retained for reproducibility. A machine-readable spreadsheet may be supplied separately as Supplementary Data when required.
- No individual participant data were used or reproduced.

Recommended cross-references in the main manuscript

- “The complete search strategies and database-specific yields are provided in the Supplementary Information.”
- “Construct mapping, primary-effect selection, extracted group-level data, data transformations, and sensitivity analyses are provided in the Supplementary Information.”
- “Detailed outcome-specific RoB 2 judgements and GRADE evidence profiles are provided in Supplementary Tables S8 and S9.”

Supplementary Note: PRISMA 2020 checklist

Completed for the construct-stratified systematic review and meta-analysis. Locations refer to the section names in the Scientific Reports submission manuscript; page and line numbers are intentionally omitted because they may change during journal processing.

Section/topic	Item	Checklist item	Location reported	Review-specific note
TITLE	1	Identify the report as a systematic review.	Title page	The shortened Scientific Reports title identifies the report as a meta-analysis; the systematic-review design is stated in the Abstract and Methods.
ABSTRACT	2	See the PRISMA 2020 for Abstracts checklist.	Abstract; PRISMA for Abstracts checklist below	The unstructured abstract reports the review scope, search date, included studies, principal syntheses, certainty, and interpretation.
INTRODUCTION	3	Describe the rationale for the review in the context of existing knowledge.	Introduction	Fall risk, psychological consequences, exercise mechanisms, and construct confusion are described.
INTRODUCTION	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Introduction	Objectives specify balance confidence, concerns about falling, and traditional falls efficacy.
METHODS	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Materials and Methods - Inclusion and Exclusion Criteria; Data Collection	PICOS criteria and construct-specific grouping are reported.
METHODS	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted, and the date when each source was last searched.	Materials and Methods - Search Strategy; Supplementary Table S1	Seven electronic sources and reference-list checking are reported; final search date 1 July 2026.
METHODS	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Supplementary Methods - complete search strategies	Complete source-specific search strings and yields are reproduced.
METHODS	8	Specify the methods used to decide whether a study met the inclusion criteria, including how many reviewers screened each record and each report retrieved.	Materials and Methods - Data Collection	Two independent reviewers; disagreements resolved by discussion or a third reviewer.
METHODS	9	Specify the methods used to collect data from reports, including how many reviewers collected data independently and any processes for obtaining or confirming data.	Materials and Methods - Data Collection	Two reviewers independently extracted and cross-checked data; supplementary reports and author contact were considered.
METHODS	10	List and define all outcomes and other variables for which data were sought, and describe assumptions made about missing or unclear information.	Materials and Methods - Inclusion and Exclusion Criteria; Data Collection; Supplementary Tables S2-S4	Constructs, instruments, sample sizes, effect sources, time points, and derivation rules are defined.
METHODS	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s), reviewers, and automation tools used.	Materials and Methods - Risk of Bias and Certainty of Evidence	Two independent reviewers used outcome-specific Cochrane RoB 2 assessments.
METHODS	12	Specify for each outcome the effect measure(s) used in synthesis or presentation of results.	Materials and Methods - Data Analysis	ABC was analysed using MD; FES-I-family outcomes using Hedges' g; traditional FES narratively.
METHODS	13	Describe the processes used to decide which studies and results were eligible for each synthesis.	Materials and Methods - Data Collection and Data Analysis; Supplementary Table S3	One primary effect per Trial_ID per construct; effect-source and time-point hierarchy reported.
METHODS	13	Describe methods required to prepare data for presentation or synthesis, such as handling missing summary statistics and data conversions.	Materials and Methods - Data Collection and Data Analysis; Supplementary Methods; Supplementary Tables S2-S4	Scale conversion, direction harmonisation, CI-derived SEs, and multi-arm combination are reported.
METHODS	13	Describe methods used to tabulate or visually display results.	Materials and Methods - Data Analysis; Figures 1-6; Tables 1-2	PRISMA flow diagram, study table, RoB plots, forest plots, sensitivity plot, and GRADE table are reported.
METHODS	13	Describe methods used to synthesise results and	Materials and Methods - Data Analysis	Inverse-variance random-effects models, REML,

Section/topic	Item	Checklist item	Location reported	Review-specific note
		provide rationale for the choices.		modified Knapp-Hartung inference, and prediction intervals are reported.
METHODS	13	Describe methods used to explore possible causes of heterogeneity among study results.	Materials and Methods - Data Analysis; Results - Sensitivity and Influence Analyses	Alternative time points/scales, intervention purity, comparator restriction, leave-one-out, and influence diagnostics are reported.
METHODS	13	Describe sensitivity analyses conducted to assess robustness of the synthesised results.	Materials and Methods - Data Analysis; Results - Sensitivity and Influence Analyses; Supplementary Tables S5-S7	Model, variance estimator, risk-of-bias, effect-source, scale, time-point, and dependence assumptions were tested.
METHODS	14	Describe methods used to assess risk of bias due to missing results in a synthesis.	Results - Reporting Bias and Missing Evidence	Registrations, protocols, supplements, and reports were compared qualitatively; formal small-study tests were not used because $k < 10$.
METHODS	15	Describe methods used to assess certainty in the body of evidence for an outcome.	Materials and Methods - Risk of Bias and Certainty of Evidence	GRADE domains and independent assessment process are reported.
RESULTS	16	Describe the results of the search and selection process, from the number of records identified to the number of studies included, ideally using a flow diagram.	Results - Study Selection; Figure 1	All stages and counts are reported.
RESULTS	16	Cite studies that might appear to meet the inclusion criteria but were excluded, and explain why they were excluded.	Results - Study Selection; Figure 1	Aggregate reasons are reported. A citation-level excluded-study list was not available in the project dataset.
RESULTS	17	Cite each included study and present its characteristics.	Results - Characteristics of the Included Studies; Table 1	Eleven trials and principal characteristics are reported.
RESULTS	18	Present assessments of risk of bias for each included study.	Results - Risk of Bias in the Included Studies; Figures 2-3; Supplementary Table S8	Study-level domain and overall judgements are presented.
RESULTS	19	For all outcomes, present summary statistics for each group and an effect estimate and precision for each study.	Results - Effects on Balance Confidence / Concerns About Falling; Figures 4-5; Supplementary Tables S3-S4	Individual-study effects, CIs, and extracted group-level data are available.
RESULTS	20	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Results - outcome sections; Risk of Bias in the Included Studies	Contributing trials and outcome-specific risk of bias are described.
RESULTS	20	Present results of all statistical syntheses, including estimates of heterogeneity and the direction of effect.	Results - Effects on Balance Confidence / Concerns About Falling; Figures 4-5	Pooled effects, 95% CIs, P values, τ^2 , I^2 , Q, and prediction intervals are reported.
RESULTS	20	Present results of investigations of possible causes of heterogeneity.	Results - Sensitivity and Influence Analyses; Supplementary Tables S5-S7	Influential studies and intervention/data-selection checks are reported; no formal meta-regression was conducted.
RESULTS	20	Present results of all sensitivity analyses.	Results - Sensitivity and Influence Analyses; Supplementary Tables S5-S7	Prespecified sensitivity analyses are fully tabulated.
RESULTS	21	Present assessments of risk of bias due to missing results for each synthesis assessed.	Results - Reporting Bias and Missing Evidence	Qualitative assessment is reported; formal asymmetry tests were not undertaken.
RESULTS	22	Present assessments of certainty in the body of evidence for each outcome.	Results - Certainty of Evidence; Table 2; Supplementary Table S9	GRADE ratings and downgrade reasons are reported.
DISCUSSION	23	Provide a general interpretation of the results in the context of other evidence.	Discussion	Results are interpreted alongside previous reviews and construct theory.
DISCUSSION	23	Discuss limitations of the evidence included in the review.	Discussion	Small evidence base, clinical heterogeneity, self-report measurement, and imprecision are discussed.
DISCUSSION	23	Discuss limitations of the review processes used.	Discussion	Missing-evidence assessment, reconstructed values, and timing of SAP Version 2.0 are discussed.
DISCUSSION	23	Discuss implications of the results for practice, policy, and future research.	Discussion	Construct-specific assessment and future trial priorities are reported.
OTHER	24	Provide registration information for the review,	Materials and Methods	PROSPERO CRD420261459443.

Section/topic	Item	Checklist item	Location reported	Review-specific note
		including register name and registration number, or state that the review was not registered.		
OTHER	24	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	PROSPERO registration; Supplementary Note - Protocol amendments and reproducibility notes	The review is registered in PROSPERO; the analysis-plan timing and amendments are documented in this Supplementary Information.
OTHER	24	Describe and explain any amendments to information provided at registration or in the protocol.	Discussion; Supplementary Table S10	Timing and substantive amendments are explicitly documented.
OTHER	25	Describe sources of financial or non-financial support and the role of funders or sponsors.	Funding	The authors received no specific funding for this work.
OTHER	26	Declare competing interests of review authors.	Competing interests	The authors declare no competing interests.
OTHER	27	Report which materials are publicly available and where they can be found.	Data availability; Supplementary Information	Supporting methods, study-level data, analysis audit trail, RoB 2 judgements, GRADE profile, and checklists are provided with the submission.

Note: PRISMA item 16b is reported at the level available in the project records. A citation-level list of all excluded full-text reports should be added if the screening log becomes available.

Supplementary Note: PRISMA 2020 for Abstracts checklist

Topic	Checklist item	Location reported	Note
Title	Identify the report as a systematic review.	Title page	The title explicitly identifies a meta-analysis; the systematic-review design is stated in the Abstract and Methods.
Objectives	Provide an explicit statement of the main objective(s) or question(s).	Abstract	The target constructs and purpose are stated, although no separate Objective heading is used because Scientific Reports requires an unstructured abstract.
Eligibility criteria	Specify inclusion and exclusion criteria.	Abstract / Materials and Methods	The abstract identifies exercise RCTs in adults with MCI or mild-to-moderate dementia; detailed criteria are in Materials and Methods.
Information sources	Specify databases and date of last search.	Abstract	Seven databases; last search 1 July 2026.
Risk of bias	Specify methods used to assess risk of bias.	Materials and Methods	RoB 2 is reported in the main Methods; the current unstructured abstract does not name the tool.
Synthesis methods	Specify methods used to present and synthesise results.	Materials and Methods	REML random-effects models and modified Knapp-Hartung inference are reported in Methods; not named in the current abstract.
Included studies	State the number of included studies and participants.	Abstract	Eleven trials; 950 randomised participants.
Synthesis results	Present main results with effect estimates and precision.	Abstract	MD, Hedges' g, 95% CIs, I ² and prediction intervals are reported.
Limitations	Provide a brief summary of limitations of the evidence.	Abstract	Uncertainty and low/very-low certainty are reported; heterogeneity is quantified for balance confidence.
Interpretation	Provide a general interpretation and important implications.	Abstract	Construct-specific interpretation is reported.
Funding	Specify primary source of funding.	Funding	No specific funding; not stated in the current abstract.
Registration	Provide register name and number.	Materials and Methods	PROSPERO CRD420261459443; not stated in the current abstract.

Note: Scientific Reports requires an unstructured abstract. The checklist therefore uses the single Abstract paragraph where applicable and identifies items that are reported elsewhere in the manuscript rather than in the abstract.