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Review Article

Structured exercise interventions for reducing anxiety in older adults across settings and health conditions: A systematic review

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Abstract

Background: Anxiety is a common psychological problem among older adults and is often not optimally managed. Pharmacological treatment may be limited by side effects and tolerability concerns in later life. Structured exercise interventions have been proposed as feasible non-pharmacological approaches, but evidence focused specifically on anxiety reduction across different older adult populations remains fragmented.
Objective: To synthesize evidence on the effectiveness of structured exercise interventions in reducing anxiety among adults aged 60 years and older across different settings and health conditions.
Methods: A systematic literature review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020. PubMed, ScienceDirect, CrossRef, Scopus, and Google Scholar were searched for studies published from 2015 to 2025, with the final search conducted on April 8, 2026. Randomized controlled trials and quasi-experimental studies involving structured exercise and validated anxiety measures were included. Study quality was appraised using Joanna Briggs Institute (JBI) tools and findings were synthesized narratively.
Results: Eleven studies were included. Most studies reported reductions in anxiety after aerobic exercise, resistance training, multimodal programs, or home-based routines. Effects were reported among healthy/community-dwelling older adults, nursing home residents, and participants with chronic conditions, including those with cancer and Parkinson's disease. Interventions lasting 6-12 weeks with 2-4 sessions per week were most frequently linked with improved anxiety outcomes. Despite heterogeneity in designs and instruments, results were generally consistent in direction.
Conclusions: Structured exercise interventions are generally associated with reduced anxiety in older adults across multiple settings and health conditions. Further high-quality studies are needed to clarify the most effective exercise prescription and the long-term sustainability of benefits.

Background

As populations age, the need for health care and supportive services continues to increase (Wulansari et al., 2018). The World Health Organization (WHO) projects the global older-adult population will increase from 1.0 billion (2020) to 2.1 billion by 2050 (World Health Organization, 2024). Aging is associated with adverse health consequences (Kirk et al., 2025), including mental health problems such as depression and anxiety (Jalali et al., 2024). Anxiety is particularly relevant in later life, especially among older adults with chronic disease, with symptom prevalence of 15–52% and diagnosed disorders of 3–15% (Kazeminia et al., 2020). Late-life anxiety may involve persistent distress, apprehension, and physical or psychological symptoms, highlighting the need for safe, feasible, and evidence-based management strategies (Jalali et al., 2024; Fauzika et al., 2023).

Pharmacological approaches remain widely used; however, several limitations are particularly relevant in older populations. Long-term use of anxiolytics and benzodiazepines is generally not recommended due to the risk of adverse effects, while antidepressants, commonly prescribed for anxiety, have limited evidence regarding effectiveness and tolerability, especially among older adults in long-term care facilities (Atchison et al., 2022). These concerns increase the clinical and public health relevance of non-pharmacological interventions as safer alternatives to support mental health in older adults (Atchison et al., 2022). Non-pharmacological approaches have also been reported to reduce anxiety in healthcare settings (Putri et al., 2025; Yanti S et al., 2026).

Structured exercise is an important strategy for improving older adults' health and refers to planned, repetitive physical activity aimed at

maintaining or improving physical fitness (Peng et al., 2022; Thivel et al., 2018). It may include aerobic, strength, flexibility, and balance components (Galloza et al., 2017; Qiu et al., 2023). Its potential mental health benefits may occur through increased brain-derived neurotrophic factor (BDNF), insulin-like growth factor 1 (IGF-1), reduced oxidative stress, and endorphin release (Ruiz-Gonzalez et al., 2021) (Stein et al., 2021; Umegaki et al., 2021; Ardila et al., 2025). Combined aerobic and resistance training has also been associated with improved anxiety, depression symptoms, well-being, and quality of life in older adults, supporting structured exercise as a plausible non-pharmacological approach for anxiety management in later life (Qiu et al., 2023).

Despite growing interest in exercise-based mental health interventions for older adults, several important gaps remain. Previous systematic reviews have provided valuable evidence but differ from the present review in scope and emphasis. Frost et al. (2019) synthesized non-pharmacological interventions for depression and anxiety in older adults with physical comorbidities, meaning exercise was only one part of a broader intervention category and anxiety was not consistently isolated as the primary outcome. Recent meta-analyses by S. Goodarzi et al. (2024) and Z. Goodarzi et al. (2025) focused more directly on physical activity for anxiety in older adults, but their emphasis was primarily on estimating pooled effects from randomized evidence rather than narratively comparing how exercise modality, delivery context, comparator intensity, and participant health condition shape anxiety outcomes.

Therefore, this systematic review aims to synthesize evidence on the effectiveness of structured exercise interventions in reducing anxiety among older adults across settings and health conditions. The main novelty of this review lies in its anxiety-specific focus in adults aged 60 years and older while integrating evidence across randomized and quasi-experimental studies, multiple exercise modalities, and different care contexts. By comparing aerobic, resistance, multimodal, dual-task, and home-based interventions across community, long-term care, and clinical populations, this review clarifies not only whether structured exercise is associated with anxiety reduction, but also which intervention characteristics and contextual factors appear most relevant for interpretation. Accordingly, this review addresses the following question: What forms and characteristics of structured exercise interventions are associated with reduced anxiety among older adults across settings and health conditions.

Methods

Study Design

This study employed a systematic review design reported according to PRISMA 2020 (Page et al., 2021). Secondary data from published journal articles were synthesized narratively due to heterogeneity in study designs, interventions, and anxiety measures. Because only publicly available studies were analyzed and no direct participant involvement occurred, ethical approval and informed consent were not required, ethical conduct was ensured through transparent reporting and accurate citation.

Research Question

The review question was formulated using the PICO framework, where the population was older adults aged 60 years and older, the intervention was structured exercise (aerobic, resistance, flexibility, balance, or combinations), comparators were not restricted (e.g., usual care, non-exercise controls, alternative interventions, or pre–post comparisons), and the outcome was anxiety measured using validated instruments. Accordingly, the review question was: What forms and characteristics of structured exercise interventions are associated with reduced anxiety among older adults across settings and health conditions?

Inclusion and Exclusion Criteria

Eligibility criteria were defined as a priori. Studies included if they were original research articles with RCT or quasi-experimental designs, involved participants aged 60 years and older, implemented a structured exercise intervention, and assessed anxiety using standardized/validated instruments. Studies were also required to be full-text accessible, published between 2015 and 2025, and written in English or Indonesian. Studies were excluded if they were reviews, meta-analyses, editorials,

or commentaries; if they did not involve a structured exercise intervention; if the population was not older adults; or if anxiety was not measured or was assessed using instruments that were not valid/unclear.

Search Strategy

A systematic search was conducted across PubMed, ScienceDirect, Scopus, CrossRef, and Google Scholar. Searches were limited to publications from 2015-2025, with the final database search conducted on April 8, 2026. Where database filters permitted, restricted to English or Indonesian full-text articles. The search strategy combined the following keyword concepts using Boolean operators: ("older adults" OR "elderly") AND ("exercise" OR "physical exercise" OR "physical activity" OR "light exercise" OR "aerobic exercise" OR "resistance exercise" OR "flexibility exercise" OR "balance exercise") AND ("anxiety" OR "anxiety level" OR "anxiety symptoms"). The search strategy was adjusted according to the syntax and filter options of each database.

Study Selection Process

Study selection followed PRISMA 2020 stages of identification, screening, eligibility, and inclusion (Page et al., 2021). Records were managed using Mendeley, and duplicates were removed before screening. Two reviewers (ARF and ADP) independently screened titles and abstracts against the eligibility criteria, followed by independent full-text assessment of potentially relevant studies. Disagreements at each stage were resolved through discussion until consensus was reached, and consultation with a third reviewer was not required. Reasons for full-text exclusion were recorded and grouped into the categories shown in the PRISMA flow diagram, including population mismatch, unclear findings, inaccessible full text, language incompatibility, unsuitable intervention, and incompatible study design. No separate supplementary list of excluded full-text articles was submitted. The selection process is summarized in a PRISMA flow diagram, and 11 studies were included in the final synthesis.

Table 1. Quality appraisal of the RCTs

Authors (years)	Question Number													Total Score
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Ferreira et al., 2018	Y	U	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	8
Ruiz-Comellas et al., 2022	Y	U	Y	N	N	Y	N	Y	Y	N	N	Y	Y	7
Cunha et al., 2021	Y	U	Y	N	N	Y	N	Y	Y	N	N	Y	Y	7
Mikkelsen et al., 2022	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	9
Porserud et al., 2024	Y	Y	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	9
Ibrahim et al., 2023	Y	U	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	8
Loh et al., 2019	Y	U	Y	N	N	Y	N	Y	Y	N	N	Y	Y	7
Aguiñaga et al., 2018	Y	U	Y	N	N	Y	N	Y	Y	N	N	Y	Y	7
Rezola-Pardo et al., 2019	Y	U	Y	N	N	Y	U	Y	Y	U	U	Y	Y	7

Notes. Y = Yes = 1, N = No = 0, U = Unclear = 0

Table 2. Quality appraisal of the quasi-experimental studies

Authors (years)	Question Number									Total Score
	1	2	3	4	5	6	7	8	9	
Tri Maghfuroh et al., 2024	Y	N	N	Y	Y	Y	Y	Y	Y	7
Maung et al., 2022	Y	N	N	Y	Y	Y	Y	Y	Y	7

Notes. Y = Yes = 1, N = No = 0, U = Unclear = 0

Quality Appraisal

Methodological quality of included studies was assessed using Joanna Briggs Institute (JBI) critical appraisal tools appropriate to study design. The JBI Critical Appraisal Checklist for Randomized Controlled Trials was applied to RCTs (Barker et al., 2023), and the JBI Checklist for Quasi-Experimental Studies was applied to quasi-experimental (pre-post) studies (Barker

et al., 2024). Quality appraisal was conducted independently by two researchers (ARF and ADP) to minimize bias. Each checklist item was rated Yes, No, Unclear, or Not Relevant, and disagreements were resolved through discussion until consensus was achieved. Summary appraisal results were reported in Tables 1 and 2.

Data Extraction and Synthesis

Data were extracted using a structured extraction form that included author, year, country, study design, population, sample size, setting, health condition, intervention type, duration, frequency, session length, comparator, anxiety instrument, and main findings. Data extraction was conducted independently by two reviewers (ARF and ADP) to reduce transcription and interpretation errors. Extracted data were compared between reviewers, and discrepancies were resolved through discussion and rechecking the full-text article until consensus was reached. Because of heterogeneity across intervention characteristics and anxiety measures, meta-analysis was not conducted. Instead, findings were synthesized narratively, with attention to exercise modality, participant context, comparator intensity, and patterns in reported anxiety outcomes.

Results

The database search identified 665 records (PubMed 45, ScienceDirect 220, Scopus 60, CrossRef 40, Google Scholar 300). After removing 85 duplicates, 580 records were screened; 520 were excluded, leaving 60 full texts assessed. 49 full texts were excluded (population mismatch n=12; unclear findings n=5; inaccessible n=6; language n=4; unsuitable intervention n=13; design n=9), and 11 studies were included (Figure 1).

The 11 included studies were mainly RCTs (including multicenter, single-blind, and double-blind trials), with two quasi-experimental pre–post studies. In total, 1,127 adults aged 60 years and older were included. Participants came from community, nursing home/long-term care, and clinical settings (e.g., chemotherapy or chronic disease treatment), and health status ranged from healthy/low-active to mild-moderate anxiety and chronic conditions such as Parkinson's disease and advanced cancer. Most studies excluded older adults with severe cognitive impairment, indicating that participants generally had sufficient functional capacity to engage in exercise programs. Detailed study and participant characteristics are summarized in Table 3.

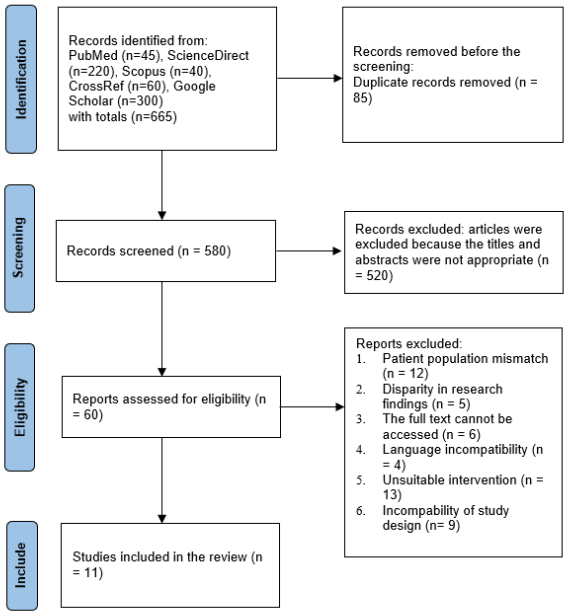

Figure 1. PRISMA Flow Diagram

Exercise interventions varied across studies and were tailored to older adults' capabilities. Aerobic-based interventions included group walking (Ruiz-Comellas et al., 2022), treadmill training at low-to-moderate intensity (Ibrahim et al., 2023), and low-impact Triloka aerobic (Tri Maghfuroh et al., 2024). Resistance-focused interventions were also reported (Ferreira et al., 2018; Cunha et al., 2021; Loh et al., 2019). Several studies applied multimodal or multicomponent programs (e.g., combinations of resistance training, walking, strengthening, balance training, counseling, or protein supplementation), including multicomponent strength-and-balance training and dual-task training (Mikkelsen et al., 2022; Maung et al., 2022; Rezola-Pardo et al., 2019). Intervention duration ranged from 3 weeks to 6 months, exercise frequency ranged from 2 to 7 sessions per week, and session length ranged from 20 to 60 minutes. Comparison conditions varied and included usual/standard care, educational sessions without exercise, non-exercise

controls, passive controls, active controls, or the absence of a control group.

The included studies assessed anxiety using validated instruments, including the Beck Anxiety Inventory (BAI), Generalized Anxiety Disorder-7 (GAD-7), Hamilton Anxiety Rating Scale (HARS), Hospital Anxiety and Depression Scale—Anxiety subscale (HADS–Anxiety), State–Trait Anxiety Inventory (STAI), DASS-21 Anxiety, and the Goldberg Anxiety Scale.

Several trials reported significant anxiety improvements versus controls (Ferreira et al., 2018; Ruiz-Comellas et al., 2022; Cunha et al., 2021; Mikkelsen et al., 2022; Ibrahim et al., 2023; Loh et al., 2019; Aguiñaga et al., 2018; Rezola-Pardo et al., 2019). Aerobic, resistance, and multimodal/home-based programs generally reduced anxiety across community, nursing home, and clinical populations. However, one trial found no significant between-group difference despite within-group improvement in the supervised arm (Porserud et al., 2024), while multicomponent exercise showed a more favorable anxiety pattern than dual-task training, which tended to increase anxiety (Rezola-Pardo et al., 2019). Overall, the evidence supports structured exercise as a potential anxiety-reducing intervention in older adults, although certainty varied by study design, comparator type, and anxiety instrument.

Table 3. Summary of data items

Study	Design	Population Characteristics	Sample Size & Age	Intervention (Exercise) & Dose	Comparison Group	Anxiety Measure & Key Finding
Ferreira et al., 2018	RCT	Older adults ≥60 with Parkinson's disease (stage 1–3)	N=35 (IG=18; CG=17); mean age IG 64.1±7.0; CG 67.6±8.9	Resistance training; 2×/week; 30–40 min/session; 6 months	Routine pharmacological therapy	BAI: IG 18.0±7.1→12.2±5.5 (p=0.0001; ES=−0.415); CG 21.3±7.2→19.9±9.5 (p=0.37; ES=−0.082).
Ruiz-Comellas et al., 2022	Multicenter RCT	Older adults >64 with anxiety/depression/low social support; able to walk 1 hour, 2×/week	N=90 (IG=45; CG=45); mean age IG 75±6; CG 74±5.18	Group walking (moderate aerobic); 2×/week; 4 months	Standard primary care	GAD-7: change IG −5.11±5.73 (p<0.001) vs CG −1.83±4.48 (p=0.019); between-group p=0.009; remission 76.5% vs 50% (RR 1.45, 95% CI 1.02–2.07).
Tri Maghfuroh et al., 2024	Pre-experimental (one-group pre-post test)	Older adults >60 with mild–moderate anxiety	N=32; majority 60–74 (84%)	Triloka exercise (low-impact aerobic); 16 sessions; 30 min/session; daily program; 3 weeks	None	HARS: 22.55→12.73 (Wilcoxon p<0.001).
Cunha et al., 2021	RCT	Women ≥60, healthy & independent; no major comorbidities/ psychiatric history	N=41 (IG=25; CG=16); mean age 68±8	Progressive resistance training (8 whole-body exercises); 3×/week; 12 weeks	Maintain usual lifestyle	BAI: IG 4.07±5.68→2.33±3.71; CG 5.18±7.70→9.81±7.10; time×group interaction P<0.001.
Mikkelsen et al., 2022	RCT	Older adults ≥65 with advanced cancer receiving systemic treatment	N=84 (IG=41; CG=43); mean age 72	Multimodal exercise; 2×/week; 12 weeks	Standard oncological care	HADS-A: mean change IG −2.3 (SD 3.0) (p=0.001) vs CG −0.6 (SD 2.9) (p=0.306); between-group change −1.8 (SE 0.7), p=0.033.
Porserud et al., 2024	Single-blind RCT	Bladder cancer; post robot-assisted radical cystectomy; no	N=90 (IG=45; CG=45); mean age 71.5±8.5	Supervised program (aerobic + strengthening + abdominal/pelvic floor) + daily	Active control: home-based walking + sit-to-stand (instructions	HADS-A (median [IQR]): IG 6 [6]→2.5 [5] (p<0.001); CG 7 [5]→4 [6] (p=0.123);

Study	Design	Population Characteristics	Sample Size & Age	Intervention (Exercise) & Dose	Comparison Group	Anxiety Measure & Key Finding
		cognitive impairment		walking goals; 2×/week; 12 weeks	only; not supervised)	between-group p=0.065 (ns).
Ibrahim et al., 2023	Double-blind RCT	Post-COVID-19 elderly aged 60-80 years	N=72 (MIG=24; LIG=24; CG=24); mean age ~62.5	Treadmill aerobic training: MIG 50–70% HRmax; LIG 40–50% HRmax; 4×/week; 40 min/session; 10 weeks	Medical care & advice (no exercise)	HADS-A: MIG 20.00±1.44→12.21±1.22 and LIG 20.17±1.69→12.71±1.40 (both p<0.01) vs CG 19.79±1.93→14.79±2.57; MIG vs LIG p=0.61 (ns).
Maung et al., 2022	Single-group pretest-posttest design	Nursing home residents; mild–moderate depression; some mild anxiety at baseline	N=39; age 60–90; mean age 70.5±8.3	Aerobic + strengthening; 3×/week; 12 weeks	None	DASS-21 Anxiety: median 3.5→2.2 (Wilcoxon p<0.001); 29/39 improved.
Loh et al., 2019	Exploratory secondary analysis of RCT	Older adults ≥60 with cancer (77% breast cancer) during chemotherapy	N=252 (IG=130; CG=122); median age 67 (range 60–89)	Home-based aerobic + resistance; 6 weeks; walking daily + resistance (~2 days/week); mean duration ~22 min	Usual care	STAI: IG reduced anxiety (p=0.001); greatest effect among high baseline anxiety (−5.39 points at 75th percentile).
Aguiñaga et al., 2018	RCT	Low-active older adults living independently (Illinois)	N=307 (IG=158; CG=149); mean age ~70	Home-based DVD program (flexibility + toning/strength + balance); 6 months; support calls every 2 weeks–1 month	Healthy Aging DVD (non-exercise)	HADS-A (high-anxiety subgroup): IG 9.30±1.16→5.30±1.57 (d=2.90) vs CG 11.36±3.17→8.91±3.53 (d=0.73); time×treatment F=1.17, P=0.30, η^2=0.06.
Rezola-Pardo et al., 2019	Single-blind RCT	Long-term nursing home residents ≥70	N=85; mean age 84.8; 68% female	Multicomponent exercise: progressive strength + balance; 2×/week; ~60 min/session; 3 months	Dual-task group: same exercises + simultaneous cognitive tasks	Goldberg Anxiety Scale: multicomponent group 2.0(2.5) → 0.9(1.6) (within-group significant; ES=0.43) but not in the dual-task group 1.5(2.0) → 1.6(2.0) (ES=0.07), with between-group p=0.09 (ns).

Notes: Values are reported as mean±SD unless stated otherwise; medians are reported as median [IQR]. RCT = randomized controlled trial; IG = intervention group; CG = control group; MIG = moderate-intensity group; LIG = low-intensity group; BAI = Beck Anxiety Inventory; GAD-7 = Generalized Anxiety Disorder-7; HARS = Hamilton Anxiety Rating Scale; HADS-A = Hospital Anxiety and Depression Scale (Anxiety subscale); STAI = State–Trait Anxiety Inventory; DASS-21 Anxiety = Depression Anxiety Stress Scales-21 (Anxiety subscale); HRmax = maximum heart rate; IQR = interquartile range; SD = standard deviation; SE = standard error; ES = effect size; ns = not significant; η^2 = eta squared.

Discussion

This systematic review synthesizes evidence on structured exercise intervention for reducing anxiety in older adults across different settings and health conditions. Overall, most included studies reported reductions in anxiety following exercise interventions, supporting exercise as a feasible non-pharmacological option in later life. However, effect size and statistical significance varied by exercise modality, comparator intensity (active vs inactive control), baseline symptom severity, and anxiety instrument (Porserud et al., 2024).

Aerobic interventions may reduce anxiety by improving cardiorespiratory endurance and influencing neurogenesis, neurotransmitter balance, cerebral blood flow, and neurotrophic factors (Hu et al., 2020). In post-COVID-19 older adults, 10 weeks of treadmill training reduced HADS-anxiety in both moderate- and low-intensity groups, with no significant difference between intensities (MIG vs LIG p=0.61), suggesting that intensity may not be the main driver of improvement in this context (Ibrahim et al., 2023). In primary care, group walking twice weekly for four months reduced GAD-7 more than standard care (−5.11±5.73 vs −1.83±4.48; p=0.009) and produced higher remission proportions (76.5% vs 50%) (Ruiz-Comellas et al., 2022). A short one-group study also found reduced HARS scores after low-impact Triloka exercise (22.55 to 12.73; p<0.001), although causal inference is limited by the absence of a control group (Tri Maghfuroh et al., 2024). These findings are biologically plausible because aerobic exercise may affect dopamine, serotonin, BDNF, HPA-axis activity, and inflammation relevant to anxiety regulation (He et al., 2024; Adasik et al., 2025).

Although less represented than aerobic modalities, resistance training also supported anxiety reduction in older adults, including clinical populations (Lei et al., 2026). In older adults with Parkinson's disease, resistance training reduced BAI scores (18.0±7.1 to 12.2±5.5; p=0.0001), while the pharmacological-therapy-only control group showed no significant change (21.3±7.2 to 19.9±9.5; p=0.37) (Ferreira et al., 2018). In healthy older women, progressive resistance training reduced BAI scores (4.07±5.68 to 2.33±3.71), whereas the non-exercise group worsened (5.18±7.70 to 9.81±7.10), with a significant time×group interaction (P<0.001)) (Cunha et al., 2021). These effects may reflect long-term metabolic, structural, and functional adaptations, as well as cortisol and HPA-axis regulation, which support stress coping and anxiolytic responses (Qiu et al., 2023; Lei et al., 2026).

Several studies suggest that combining aerobic and resistance components, or using multicomponent programs, may provide broader benefits by improving physical resilience and overall well-being in older adults (Fang et al., 2025; Maung et al., 2022). Among older patients receiving systemic cancer treatment, a 12-week multimodal intervention reduced HADS-anxiety more than standard oncological care with a significant between-group difference (−1.8, SE 0.7, p=0.033) (Mikkelsen et al., 2022). In nursing home residents, a 12-week aerobic-plus-strengthening program was associated with lower DASS-21 anxiety, although the lack of a control group limits causal inference (Maung et al., 2022). Potential mechanisms include HPA-axis, serotonergic, and neuroplasticity pathways (Sampedro-Piquero & Moreno-Fernández, 2021; Zhou et al., 2022; Ten et al., 2022; Lewicka et al., 2025).

At the same time, a balanced interpretation requires acknowledging that not all multicomponent trials demonstrated clear superiority versus active comparators (Porserud et al., 2024). In older bladder cancer patients, supervised multimodal exercise improved within-group HADS-anxiety, but the active home-based control also improved, and the between-group difference did not reach statistical significance (Porserud et al., 2024). This suggests that comparator intensity (i.e., an "active" control with meaningful activity) may attenuate between-group contrasts even when supervised programs appear beneficial (Porserud et al., 2024). A further diverging hypothesis concerns whether adding cognitive load enhances or undermines anxiolytic outcomes (Rezola-Pardo et al., 2019). In long-term care residents, multicomponent training reduced Goldberg anxiety, whereas the dual-task group showed no improvement, yet the between-group comparison remained non-significant, indicating uncertainty about comparative superiority despite a directionally favorable pattern for the multicomponent program (Rezola-Pardo et al., 2019).

Home-based exercise may improve scalability and access, especially for older adults with mobility limitations or treatment demands (Loh et al., 2019; Aguiñaga et al., 2018). Exercise-based reviews have highlighted broader psychological and functional benefits of

structured exercise, supporting more focused reviews on anxiety in older adults (Chalkia et al., 2025). In chemotherapy patients, a home-based aerobic plus resistance program showed significant STAI group differences and larger effects in those with higher baseline anxiety (Loh et al., 2019). In low-active older adults with elevated baseline anxiety, a DVD program reduced anxiety more in the intervention group than controls, though the time×treatment interaction was not significant, likely due to limited subsample power (Aguiñaga et al., 2018). These findings align with evidence on neural and interoceptive mechanisms relevant to anxiety perception (Clemente et al., 2024).

More broadly, older adults engaging in regular physical exercise tend to show improved musculoskeletal and functional profiles compared with inactive peers, which may indirectly support psychological resilience (Babaei Bonab & Parvaneh, 2022). Exercise may also enhance parasympathetic activity and reduce sympathetic stress responses, contributing to lower physiological arousal relevant to anxiety (Fang et al., 2025). Evidence also supports the role of endorphin and neurotransmitter release in promoting comfort and well-being, which may help explain reductions in anxiety and related mood outcomes (Kandola et al., 2018; Lei et al., 2026). Community-based studies have likewise reported reductions in anxiety and depression alongside quality-of-life improvements following physical activity engagement, supporting broader mental health benefits of exercise in older populations (Tao et al., 2025).

Regarding intervention "dose," included studies ranged from three weeks to six months, and many meaningful anxiety improvements were observed in programs lasting approximately 6-12 weeks (Z. Goodarzi et al., 2025). Across studies, exercise frequency varied from two to seven sessions per week, but several effective protocols used 2-4 sessions per week across 6-12 weeks, suggesting a pragmatic and feasible program window for older adults (Ruiz-Comellas et al., 2022; Cunha et al., 2021; Mikkelsen et al., 2022; Ibrahim et al., 2023). However, the optimal dose remains unclear because intensity reporting and adherence were inconsistent, and outcomes varied according to whether studies used inactive or active controls. (Porserud et al., 2024; Ibrahim et al., 2023). Additionally, the lack of clear superiority between low and moderate intensity treadmill prescriptions indicates that dose–response relationships may not be linear and require standardized head-to-head testing (Ibrahim et al., 2023).

A central limitation is substantial heterogeneity in participant characteristics (healthy/community-dwelling, nursing home residents, and multiple clinical conditions), which limits the generalizability of any single exercise prescription (S. Goodarzi et al., 2024). Intervention heterogeneity (aerobic, resistance, multicomponent, home-based, and dual-task formats) also makes it difficult to identify which components drive anxiolytic effects (Fang et al., 2025; Maung et al., 2022; Rezola-Pardo et al., 2019). Anxiety outcomes were assessed using diverse instruments, which may differ in sensitivity to change and contribute to inconsistent effect magnitudes (Ferreira et al., 2018; Ruiz-Comellas et al., 2022; Mikkelsen et al., 2022). Comparator choice is another key issue, as active controls can attenuate between-group differences relative to usual care or education-only controls (Porserud et al., 2024). Including one-group pre-post studies increases susceptibility to confounding (e.g., regression to the mean, expectancy effects, concurrent care, and natural symptom fluctuation), reducing certainty even when within-group changes are significant (Tri Maghfuroh et al., 2024; Maung et al., 2022). Finally, limited blinding in exercise trials may introduce performance and detection bias, requiring cautious interpretation of effect sizes and comparative superiority (Ferreira et al., 2018; Cunha et al., 2021; Porserud et al., 2024).

Although exercise and mental health have been widely studied, the main added value of this review lies in its specific focus on anxiety as the primary outcome in adults aged 60 years and older. In addition, this review compares evidence across multiple exercise modalities, settings, and health conditions, while also highlighting how comparator intensity and intervention structure may shape interpretation

of effectiveness. In particular, the included evidence suggests that (1) comparator intensity materially affects conclusions, (2) adding cognitive load through dual-task formats may not necessarily enhance anxiolytic outcomes in frailer older adults, and (3) home-based delivery can still produce meaningful improvements, especially among those with higher baseline anxiety.

The evidence suggests that structured exercise interventions are generally associated with reduced anxiety in older adults, but the strength of evidence varies across modalities, comparators, and baseline symptom severity (Ruiz-Comellas et al., 2022; Mikkelsen et al., 2022; Porserud et al., 2024; Aguiñaga et al., 2018). Programs delivered over approximately 6-12 weeks with 2-4 sessions per week were commonly linked with anxiety improvements, although dose response inferences remain tentative due to heterogeneous reporting and limited head-to-head comparisons (Ibrahim et al., 2023; Martínez-Domínguez et al., 2018). These findings inform the concluding statement that exercise can be considered a feasible non-pharmacological component of anxiety management in later life while highlighting the need for standardized reporting and longer-term follow-up (Loh et al., 2019).

Conclusion and Recommendation

Overall, the included studies indicate that structured exercise interventions are generally associated with reduced anxiety levels among older adults across diverse intervention settings and health conditions, although the strength of evidence varies by study design, comparator type, and outcome measurement. A commonly reported program pattern was exercise delivered approximately 2-4 sessions per week over 6-12 weeks, but an optimal dose cannot be established due to heterogeneity in intervention components and incomplete standardization of intensity and outcome reporting. Importantly, trials using active control conditions did not always show significant differences despite within-group improvements, underscoring the need for cautious interpretation of comparative effectiveness. Future research should prioritize adequately powered RCTs with standardized reporting of exercise dose (frequency, intensity, time, and type), consistent anxiety outcome measures, and longer follow-up periods to evaluate the sustainability of effects and clarify which modalities and delivery models are most effective for specific older adult subgroups.

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