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# PHYSICAL ACTIVITY AS A NON-PHARMACOLOGICAL INTERVENTION FOR DEPRESSIVE SYMPTOMS IN OLDER ADULTS — A NARRATIVE REVIEW

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**ABSTRACT**

**Background.** Depression is a common mental health disorder among older adults and is associated with impaired quality of life, functional decline, and increased morbidity. Physical activity has emerged as a promising non-pharmacological intervention; however, uncertainty remains regarding the optimal exercise prescription and the comparative effectiveness of exercise modalities.

**Aim.** To critically evaluate the literature regarding physical activity as a non-pharmacological intervention for depressive symptoms in older adults, with emphasis on exercise modality, exercise dose, intervention duration, long-term outcomes, and methodological limitations.

**Material and methods.** A narrative literature review was conducted using PubMed and Google Scholar. Priority was given to systematic reviews, meta-analyses, network meta-analyses, and randomised controlled trials investigating the effects of physical activity and structured exercise on depressive symptoms in older adults.

**Results.** The accumulated evidence indicates that structured exercise reduces depressive symptoms in older adults, while habitual physical activity is associated with a lower risk of developing depressive symptoms. Although aerobic, resistance, mind-body, walking, neuromotor, and multicomponent exercise have all demonstrated beneficial effects, no single exercise modality has shown consistent superiority among studies. Exercise dose, programme duration, and adherence may influence treatment outcomes, but the optimal exercise prescription remains uncertain because of substantial methodological heterogeneity.

**Conclusions.** Structured exercise is an effective non-pharmacological intervention for reducing depressive symptoms in older adults and should be considered as part of comprehensive depression management. Exercise programmes should be individualised, while further high-quality studies are needed to optimise exercise recommendations and strengthen the evidence base for clinical practice.

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**KEYWORDS**

Physical Activity, Exercise, Depressive Symptoms, Older Adults, Late-Life Depression

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**1. Introduction**

Depression is a common mental disorder, affecting an estimated 332 million people worldwide (World Health Organization, 2025). Among older adults, depression is one of the most prevalent mental health conditions and is frequently under-recognised and undertreated. The World Health Organisation (WHO) reports that mental disorders account for 6.8% of the total years lived with disability among adults aged 70 years and older, with depression and anxiety being the most prevalent mental conditions in this population (World Health Organization, 2026).

According to the WHO, 1.1 billion people worldwide were aged 60 years or older in 2023, and this number is projected to almost double to 2.1 billion by 2050. As the global population ages, identifying effective, safe, and accessible strategies to prevent and manage depressive symptoms has become an important public health priority (World Health Organization, 2026).

Among older adults, depressive symptoms are associated with reduced quality of life, impaired physical functioning (Blake et al., 2009; Bridle et al., 2012), increased risk of morbidity (Lopez et al., 2006), and mortality (Cuijpers & Smit, 2002). Furthermore, approximately one in six deaths by suicide occurs among people aged 70 years or older, highlighting the substantial impact of mental health disorders in later life.

Pharmacological and psychotherapeutic interventions remain the cornerstone of depression treatment. However, depression in older adults frequently coexists with multimorbidity, chronic pain, frailty, reduced mobility, and dementia (World Health Organization, 2026), increasing the complexity of clinical management.

Exercise has been increasingly investigated as a potential non-pharmacological intervention for depressive symptoms in older adults (Schuch et al., 2016). Early systematic reviews demonstrated that structured exercise programmes produced clinically relevant improvements in depressive symptoms, although substantial heterogeneity in intervention characteristics and limited data regarding medium- and long-term effectiveness were noted (Blake et al., 2009; Bridle et al., 2012).

Subsequent evidence strengthened these findings. Schuch et al. (2016) reported a large antidepressant effect of exercise in older adults and suggested that previous meta-analyses may have underestimated this effect because publication bias had not been adequately addressed. Similarly, the umbrella review by Catalan-Matamoros et al. (2016) concluded that exercise is a safe and effective intervention for reducing depressive symptoms in older adults.

Recent network meta-analyses have compared the effectiveness of different exercise modalities and exercise doses in older adults with depressive symptoms. Miller et al. (2020) found that aerobic, resistance, and mind–body exercise were all effective compared with control conditions and that no exercise modality demonstrated clear superiority over the others, supporting exercise prescription according to patient preference. In contrast, Tian et al. (2024) reported that resistance exercise and mind–body exercise achieved the greatest reductions in depressive symptoms and additionally identified a U-shaped dose–response relationship between total exercise dose and depression outcomes. Tang et al. (2024) similarly demonstrated that different exercise modalities were associated with different optimal dose ranges.

Despite the growing body of evidence supporting exercise for depressive symptoms in older adults, several clinically relevant questions remain unresolved. Studies have reported inconsistent findings regarding the relative effectiveness of different exercise modalities, with some studies concluding no clear superiority of a specific modality, whereas others identified resistance and mind–body exercise as the most effective interventions (Miller et al., 2020; Tian et al., 2024). Moreover, the exercise type, dose, intensity, and intervention duration may influence treatment outcomes, although the optimal prescription remains uncertain (Li et al., 2024; Tang et al., 2024; Tian et al., 2024).

Interpretation of the literature is further complicated by substantial heterogeneity in participant characteristics, exercise protocols, and methodological quality across studies (Blake et al., 2009).

**Research Objective.** The aim of this narrative review was to critically evaluate the existing literature regarding physical activity as a non-pharmacological intervention for depressive symptoms in older adults. Because epidemiological data are primarily reported for depressive disorders, whereas exercise intervention studies typically evaluate changes in depressive symptom severity, the present review focuses on depressive symptoms. Emphasis is placed on the effectiveness of different exercise modalities, exercise dose, intervention duration, long-term outcomes, and the methodological limitations of the literature.

**Research Problems.** This narrative review addresses the following research problems: (1) whether habitual physical activity and structured exercise are associated with fewer depressive symptoms in older adults; (2) whether particular exercise modalities provide greater antidepressant benefits than others; (3) how exercise intensity, frequency, programme duration, total dose, adherence, and participant characteristics may influence outcomes; and (4) whether the observed benefits are maintained over time and can be achieved safely and acceptably in older populations.

**Research Hypotheses.** Because this article is a narrative review rather than an experimental study, no formal statistical hypotheses were tested. The review was guided by the working proposition that structured exercise reduces depressive symptoms in older adults and that higher habitual physical activity is associated with a lower risk of depressive symptoms, while the optimal exercise modality and dose remain uncertain.

## **2. Methodology**

### **2.1. Study design**

This study was conducted as a narrative review aimed at evaluating the effects of physical activity on depressive symptoms in older adults. Unlike a systematic review, the objective was not to identify every publication but to provide a comprehensive and critical synthesis of the most relevant research, with particular emphasis on exercise modality, exercise dose, intervention duration, long-term outcomes, and methodological limitations of the available studies.

### **2.2. Literature search strategy**

A literature search was conducted using the PubMed and Google Scholar databases. The search included studies published in English using combinations of the following keywords: "depression," "depressive symptoms," "physical activity," "exercise," "exercise therapy," "older adults," "older people," "elderly," and "late-life depression."

Reference lists of relevant systematic reviews and meta-analyses were also screened to identify additional eligible publications.

### **2.3. Eligibility criteria**

Studies were considered eligible if they investigated the relationship between physical activity or structured exercise and depressive symptoms in older adults. Priority was given to systematic reviews, meta-analyses, network meta-analyses, and randomised controlled trials.

The review primarily included studies involving participants aged 60 years and older. However, two publications were retained because they provided important results relevant to late-life depression despite not fully meeting this criterion. Mather et al. (2002) included a mixed-age sample with participants younger than 60 years, whereas one study included in the review by Mura and Carta (2013) had a mean participant age of 57 years.

Publications focusing exclusively on younger adults, children or adolescents, bipolar disorder, psychotic disorders, or non-exercise interventions were excluded.

### **2.4. Study selection and data extraction**

Studies were selected based on their relevance to the review objective and methodological quality. Emphasis was placed on recent high-quality studies, while earlier landmark systematic reviews were included to provide historical context and illustrate the evolution of research in this field.

### **2.5. Data synthesis**

The findings were synthesised narratively. Particular attention was paid to comparing the effectiveness of different exercise modalities, exercise dose, intervention duration, and long-term outcomes. Methodological heterogeneity, including differences in study populations, intervention protocols, outcome measures, and study quality, was also critically considered during the interpretation process.

#### **2.5.1. Statistical methods**

No de novo statistical analysis or meta-analysis was performed. The findings were synthesised narratively based on the results reported in the included publications.

### 3. Results

#### 3.1. Habitual physical activity and the risk of depressive symptoms

Observational studies suggest that higher habitual physical activity is associated with fewer depressive symptoms and a lower risk of depression in older adults (Bizzozero-Peroni et al., 2024; Maier et al., 2021).

A systematic review and meta-analysis by Bizzozero-Peroni et al. (2024), including 33 observational studies with 96,173 participants, demonstrated an inverse association between objectively measured daily step count and depressive symptoms. Compared with fewer than 5,000 steps/day, achieving at least 5,000 steps/day was associated with fewer depressive symptoms in cross-sectional studies, whereas accumulating at least 7,000 steps/day was associated with a lower risk of depression in prospective cohorts (RR 0.69, 95% CI 0.62–0.77). Furthermore, every additional 1,000 daily steps was associated with an approximately 9% reduction in depression risk. These associations remained significant in participants aged  $\geq 65$  years (Bizzozero-Peroni et al., 2024).

In a systematic review of longitudinal studies in adults aged  $\geq 65$  years, Maier et al. (2021) identified physical activity as a potential protective factor for incident depression, although the protective effect was not observed across all studies, largely because physical activity was assessed using heterogeneous self-reported measures, ranging from general participation in physical activity to walking frequency.

#### 3.2. Overall effectiveness of structured exercise interventions

The systematic review by Rhyner and Watts (2016) found that exercise interventions produced greater improvements in depressive symptoms in studies that specifically enrolled participants with clinically diagnosed depression than in studies involving older adults regardless of depression status. The authors concluded that exercise may represent an effective adjunctive treatment, particularly in clinically depressed populations. The meta-analysis by Schuch et al. (2016) reinforced these results, including only older adults with depression or elevated depressive symptoms. It demonstrated a large antidepressant effect of exercise, with significant effects observed across several exercise subgroups.

Cheng et al. (2025) concluded that exercise interventions significantly reduced depressive symptoms in older adults, while identifying programme characteristics such as intervention frequency and duration as potential moderators of treatment effectiveness.

These findings indicate that structured exercise remains an effective non-pharmacological intervention for reducing depressive symptoms in older adults, with particularly pronounced effects in populations with clinically significant depressive symptoms (Rhyner & Watts, 2016), although the magnitude of benefit varies according to the characteristics of the study population and intervention (Cheng et al., 2025; Schuch et al., 2016; Seo & Chao, 2018).

#### 3.3. Comparative effectiveness of exercise modalities

While most studied exercise modalities have been associated with reductions in depressive symptoms among older adults, recent network meta-analyses have reported different rankings of individual interventions, indicating that their comparative effectiveness remains inconclusive (Huang et al., 2025).

In a network meta-analysis including older adults with clinically diagnosed depression, Miller et al. (2020) compared aerobic, resistance, and mind–body exercise and found no statistically significant superiority of any modality over the others, suggesting that each may provide clinically meaningful antidepressant effects. Tian et al. (2024) ranked resistance exercise and mind–body exercise as the most effective interventions for reducing depressive symptoms, with both modalities ranking above aerobic exercise in the network meta-analysis.

Distinct network meta-analyses expanded the range of evaluated exercise modalities and produced different rankings. Tang et al. (2024) identified walking as the intervention with the highest probability of being the most effective for reducing depressive symptoms, whereas Huang et al. (2025) ranked neuromotor exercise highest, followed by mind–body, multicomponent, and resistance exercise. Huang et al. (2025) also emphasized that these rankings should be interpreted cautiously because of the limited number of studies (Huang et al., 2025; Tang et al., 2024).

Despite differences in the ranking of individual exercise modalities across network meta-analyses, the published data suggest that aerobic, resistance, mind–body, walking, neuromotor, and multicomponent exercise are all associated with improvements in depressive symptoms, with no single modality demonstrating unequivocal superiority across all analyses (Huang et al., 2025; Miller et al., 2020).

### **3.4. Exercise prescription: intensity, frequency, duration, and total exercise dose**

One of the most important unresolved questions concerns the optimal exercise prescription for older adults. The accumulated evidence suggests that the antidepressant effects of exercise are influenced not only by the type of exercise performed but also by intervention characteristics, including exercise intensity, frequency, total exercise dose, and programme duration, none of which has been fully established because of different methods to quantify exercise exposure.

#### **3.4.1. Exercise intensity**

Regarding intensity, Li et al. (2024) found significant reductions in depressive symptoms in subgroup analyses of both moderate-intensity exercise (SMD =  $-0.25$ , 95% CI  $-0.47$  to  $-0.03$ ) and high-intensity exercise (SMD =  $-0.94$ , 95% CI  $-1.37$  to  $-0.51$ ). Although the effect estimate was larger for high-intensity interventions, these findings were derived from between-study subgroup analyses and therefore do not establish the superiority of vigorous exercise. Similarly, Schuch et al. (2016) reported a significant antidepressant effect in the subgroup of moderately intense interventions. However, this finding indicates efficacy within that subgroup rather than a direct advantage over other intensities.

#### **3.4.2. Frequency and programme duration**

Literature concerning frequency and programme duration is more limited and may depend on exercise modality. In a meta-analysis restricted to multicomponent structured exercise, Cheng et al. (2025) found significant improvements for programmes conducted more than twice weekly and for interventions lasting 12–24 weeks. Meta-regression additionally identified intervention frequency as a significant moderator, whereas the findings for programme duration were based on subgroup analyses. These findings should therefore be interpreted specifically in relation to multicomponent programmes rather than exercise interventions in general. Li et al. (2024) also reported significant effects for interventions lasting three months and six months, with a larger pooled effect estimate for six-month programmes. Because this comparison was not based on direct randomisation to different programme lengths, it does not conclusively demonstrate that six months is superior to three months.

#### **3.4.3. Total exercise dose**

The most detailed prescription evidence concerns total weekly exercise dose. Tian et al. (2024) identified a nonlinear, U-shaped association between exercise dose and depressive symptoms. A significant response began at approximately 390 MET-min/week, while the study's summary identified approximately 760 MET-min/week as the estimated optimal dose. Notably, the minimum estimated effective dose was ~390 MET-min/week, which is slightly below the WHO-recommended lower limit of physical activity of 600 MET-min/week (Bull et al., 2020). The Tian et al. (2024) analysis also suggested modality-specific patterns: the largest significant response was observed at approximately 560 MET-min/week for mixed exercise and 880 MET-min/week for resistance exercise, whereas significant dose–response associations were not demonstrated for aerobic or mind–body exercise.

Tang et al. (2024) likewise reported a nonlinear dose–response relationship. The estimated overall range associated with a clinically meaningful improvement was 600–970 MET-min/week, while the broader statistically effective range was approximately 350–1000 MET-min/week and the estimated optimal dose was approximately 800 MET-min/week. Modality-specific clinically effective thresholds differed, including approximately 520–1000 MET-min/week for resistance training, 820–1000 MET-min/week for aerobic exercise, 650–1000 MET-min/week for walking, and 680–1000 MET-min/week for yoga (Tang et al., 2024).

Reviews including programmes with widely varying combinations of endurance, resistance, and mind–body exercise, as well as heterogeneous intervention schedules support the general effectiveness of structured exercise. However, they do not provide reliable comparative data from which an optimal intensity, frequency, or duration can be derived (Bridle et al., 2012; Miller et al., 2020). Similarly, the comparisons between exercise modalities reported by Huang et al. (2025) do not support a specific exercise prescription.

### **3.5. Effect modifiers and population-specific findings**

The effectiveness of exercise interventions appears to be influenced by both participant characteristics and intervention design, although the existing results are derived primarily from subgroup analyses.

Rhyner and Watts (2016) found that exercise produced greater reductions in depressive symptoms in studies enrolling older adults with clinically diagnosed depression than in studies including more heterogeneous populations. Similarly, Schuch et al. (2016) reported larger treatment effects for mixed aerobic

and anaerobic exercise, moderate-intensity programmes, group-based interventions, mixed supervised and unsupervised delivery, and participants without major clinical comorbidities.

Among multicomponent exercise programmes, Cheng et al. (2025) identified greater effectiveness in interventions lasting 12–24 weeks, performed more than twice weekly, involving participants with poorer health status and retention rates of at least 80%, with intervention frequency and retention emerging as significant moderators.

Tang et al. (2024) further suggested that the antidepressant effects of exercise diminished with advancing age, becoming non-significant in participants older than 81 years.

These findings suggest that both participant characteristics and programme design may influence treatment response, although confirmation from direct comparative studies is still required.

### **3.6. Maintenance of treatment effects**

The durability of the antidepressant effects of exercise remains uncertain because relatively few studies have included extended follow-up assessments.

In their systematic review, Blake et al. (2009) reported that most included trials demonstrated short-term improvements in depression or depressive symptoms following exercise interventions. However, the authors concluded that results regarding medium- and long-term effects remained unclear because of the limited number and heterogeneity of follow-up studies.

No significant differences between a home-based physical activity programme and an active social control during 12 months of follow-up were found by Kerse et al. (2010). Mood and mental health-related quality of life improved in both groups, suggesting that sustained social engagement may contribute to maintaining psychological benefits after structured interventions. Similar results were reported by Lavretsky et al. (2022). In older adults receiving stable antidepressant treatment, both Tai-Chi Chih and health education groups showed significant improvements in depressive symptoms at both 3 and 6 months, with no significant between-group differences in mood outcomes.

Evidence to date indicates that exercise-related improvements in depressive symptoms may persist beyond the intervention period, although the limited availability of long-term follow-up data and the use of active control conditions in several trials preclude firm conclusions regarding the maintenance of exercise-specific antidepressant effects.

### **3.7. Adherence, acceptability, and safety**

The literature suggests that exercise interventions are generally well accepted and safe for older adults, although reporting of adherence and adverse events remains inconsistent across studies.

Cheng et al. (2025) identified participant retention as a significant moderator of treatment effectiveness, with interventions achieving retention rates of at least 80% demonstrating greater reductions in depressive symptoms.

Lavretsky et al. (2022) reported no differences in dropout or tolerability between Tai Chi Chih and health education, indicating good acceptability of both interventions among older adults receiving antidepressant treatment.

The DeLLITE trial by Kerse et al. (2010) also demonstrated excellent participant retention, with 97% of participants completing the study.

Regarding safety, Catalan-Matamoros et al. (2016) found no reports of serious adverse events related to exercise interventions but highlighted that adverse events were inconsistently assessed and reported.

### **3.8. Certainty and limitations of the accumulated evidence**

Although the evidence supports the beneficial effects of physical activity on depressive symptoms in older adults, its general certainty is limited by several methodological weaknesses. Across systematic reviews and meta-analyses, substantial heterogeneity was reported with respect to participant characteristics, exercise modalities, intervention protocols, comparator groups, and depression outcome measures, limiting the comparability of pooled estimates (Cheng et al., 2025; Li et al., 2024; Tang et al., 2024).

Another important limitation is the generally low methodological quality of many primary trials. Several reviews highlighted small sample sizes, moderate to high risk of bias, the inability to blind participants and intervention providers, and relatively short intervention or follow-up periods, restricting conclusions regarding the long-term effectiveness of exercise (Catalan-Matamoros et al., 2016).

The predominantly short intervention and follow-up periods further limit the ability to determine whether the beneficial effects of exercise are sustained over the long term (Tian et al., 2024). Despite consistent support of exercise as a beneficial non-pharmacological intervention for depressive symptoms in older adults, further well-designed randomised controlled trials using standardised exercise protocols and direct comparisons between exercise modalities are needed to inform evidence-based exercise prescriptions for older adults (Huang et al., 2025).

## **4. Discussion**

### **4.1. Overall interpretation of literature**

The present narrative review demonstrates that physical activity is associated with reduced depressive symptoms in older adults. Despite considerable differences in study design, participant characteristics, exercise interventions, and outcome measures, the general direction of studies has remained remarkably consistent across both earlier and more recent systematic reviews and meta-analyses (Huang et al., 2025; Schuch et al., 2016).

This consistency has been maintained despite substantial methodological heterogeneity. Earlier reviews primarily established the antidepressant benefits of exercise, whereas more recent studies have expanded current knowledge by comparing different exercise modalities, examining dose–response relationships, and identifying factors that may influence treatment effectiveness. These advances have not altered the central conclusion that regular physical activity represents an effective non-pharmacological strategy for reducing depressive symptoms in later life (Cheng et al., 2025; Li et al., 2024; Miller et al., 2020; Tian et al., 2024).

### **4.2. The role of physical activity in the treatment of late-life depression**

When the observational and interventional evidence is considered together, physical activity appears to have two complementary roles in late-life depression.

Observational studies indicate that maintaining higher levels of habitual physical activity is associated with a lower risk of developing depressive symptoms in older adults. Longitudinal evidence consistently identifies physical activity as a protective factor for incident depression, while higher daily step counts have also been associated with a reduced risk of future depression (Bizzozero-Peroni et al., 2024; Maier et al., 2021).

In contrast, randomised controlled trials and meta-analyses demonstrate that structured exercise interventions can reduce depressive symptom severity in older adults with existing symptoms. The largest treatment effects appear to be observed in individuals with clinically significant depression, suggesting that exercise may be particularly valuable as part of a comprehensive treatment strategy rather than solely as a preventive measure (Lavretsky et al., 2022; Schuch et al., 2016).

The available literature supports the integration of physical activity into both preventive and therapeutic approaches to late-life depression. These two applications may be viewed as complementary aspects of the same behavioural intervention, adapted according to an individual's clinical status.

### **4.3. What type of exercise should clinicians recommend?**

One of the most clinically relevant questions is whether a specific type of exercise should be preferentially recommended for older adults with depressive symptoms. Although attempts to rank different exercise modalities according to their effectiveness have been made, most findings analysed for the purpose of this paper do not support a single universally superior intervention.

Meta-analyses demonstrate that a range of exercise modalities, including aerobic, resistance, mind–body, and multicomponent programmes, can effectively reduce depressive symptoms in older adults. Direct comparisons have failed in numerous cases to demonstrate statistically significant superiority of one exercise type over another (Huang et al., 2025; Miller et al., 2020).

Some authors have provided comparative rankings of exercise modalities.

For example, Tian et al. (2024) ranked resistance and mind–body exercise as the most effective interventions, while Li et al. (2024) also reported favourable outcomes for resistance exercise in subgroup analyses.

In contrast, Tang et al. (2024) ranked walking-based interventions highest and Huang et al. (2025) identified neuromotor exercise as having the highest probability of being the optimal intervention. Importantly, these rankings should be interpreted with caution because they are derived largely from indirect comparisons

and may be influenced by differences in study populations, intervention protocols, and the number of studies for each exercise modality (Huang et al., 2025; Tang et al., 2024; Tian et al., 2024).

The literature suggests that the choice of exercise modality should primarily be guided by individual preferences, functional capacity, comorbidities, and accessibility.

#### **4.4. Prescribed exercise dose in older adults**

Defining an optimal exercise prescription remains challenging despite the growing number of meta-analyses. Recent meta-analyses suggest that moderate-intensity exercise performed regularly over several months is associated with favourable outcomes (Li et al., 2024). The dose–response analyses have identified an exercise volume of approximately 600–970 MET-min/week or around 760 MET-min/week as being associated with the greatest reductions in depressive symptoms (Tang et al., 2024; Tian et al., 2024).

These estimates should not be interpreted as prescriptive clinical thresholds. They are derived from pooled analyses of heterogeneous interventions that differed in exercise modality, intensity, duration, participant characteristics, and outcome assessment. Consequently, the most appropriate exercise programme should be individualised according to functional capacity, comorbidities, previous exercise experience, and personal preferences rather than based solely on a target exercise dose (Tang et al., 2024; Tian et al., 2024).

From a clinical perspective, promoting sustainable participation may be as important as achieving a specific exercise dose, given the beneficial effects observed across a range of exercise programmes and the association between higher adherence and greater improvements in depressive symptoms (Cheng et al., 2025; Schuch et al., 2016).

#### **4.5. Which patients may benefit the most?**

Not all older adults appear to benefit to the same extent from exercise interventions. Treatment response may vary according to individual clinical characteristics. Meta-analyses report larger antidepressant effects among older adults with clinically significant depression than among those with milder depressive symptoms, supporting the role of exercise as an important component of treatment for established depression (Lavretsky et al., 2022; Rhyner & Watts, 2016; Schuch et al., 2016).

Evidence regarding other potential effect modifiers remains less consistent. An earlier meta-analysis found no significant differences in treatment effects according to participants' age. By contrast, a more recent meta-analysis suggested that very advanced age may attenuate the antidepressant effects of exercise. In addition, higher intervention adherence has been associated with greater improvements in depressive symptoms. However, these findings are derived primarily from subgroup and moderator analyses and should therefore be interpreted with caution (Cheng et al., 2025; Rhyner & Watts, 2016; Tang et al., 2024).

The accumulated evidence supports an individualised approach to exercise prescription. Rather than assuming that a single programme is optimal for all older adults, clinicians should consider each patient's depressive symptom severity, functional capacity, comorbidities, and preferences when recommending exercise as part of depression management.

#### **4.6. Clinical implications**

The findings of this review support the consideration of exercise as an adjunctive non-pharmacological intervention that may complement standard depression treatment, rather than replace evidence-based pharmacological or psychological therapies when these are indicated (Lavretsky et al., 2022; Mather et al., 2002).

From a practical perspective, exercise programmes should be tailored to the individual. Promoting long-term participation is likely to be particularly important, as higher intervention adherence has been associated with greater improvements in depressive symptoms (Cheng et al., 2025).

The generally favourable safety profile and good acceptability of exercise interventions further support their implementation in routine clinical practice. Most studies reported no serious adverse events, while high completion and retention rates indicate that appropriately prescribed exercise is both feasible and well tolerated in older adults (Catalan-Matamoros et al., 2016; Kerse et al., 2010; Lavretsky et al., 2022).

These findings may also have practical implications for the implementation of exercise in older populations. Given the absence of consistent evidence supporting the superiority of a single exercise modality, clinicians may have considerable flexibility when selecting an appropriate programme. This allows exercise recommendations to account for individual functional limitations, comorbidities, accessibility, and personal preferences. Such flexibility may be particularly relevant in older adults, in whom the feasibility of sustained participation can differ substantially between individuals (Huang et al., 2025; Miller et al., 2020).

#### 4.7. Strengths and limitations of this review

This review has several strengths. It provides an up-to-date narrative synthesis of the literature by integrating recent systematic reviews and network meta-analyses with observational evidence on physical activity and depressive symptoms. In addition to evaluating the effectiveness of exercise, it considers exercise modality, dose, treatment duration, potential effect modifiers, and the relationship between physical activity and depression across both prevention and treatment settings. Furthermore, the review incorporates studies involving both clinically diagnosed depression and depressive symptoms, providing a broader perspective on the role of physical activity in late-life depression.

Several limitations should also be acknowledged. First, this is a narrative review rather than a systematic review with a *de novo* meta-analysis; therefore, the conclusions depend on the quality and interpretation of previously published evidence syntheses. Second, substantial heterogeneity exists across the included reviews regarding participant characteristics, definitions of depression, exercise interventions, outcome measures, and methodological approaches. Finally, because many of the included systematic reviews and meta-analyses were based on overlapping primary studies, some individual trials contributed to multiple evidence syntheses, which should be considered when interpreting the results.

#### 4.8. Future research

Future research should prioritise large, well-designed randomised controlled trials using standardised exercise protocols and consistent outcome measures to improve the comparability of data across studies. Greater methodological consistency would facilitate more reliable conclusions regarding the optimal exercise prescription for older adults with depressive symptoms (Huang et al., 2025; Tian et al., 2024).

Further studies with longer follow-up periods are needed to determine the durability of treatment effects and to identify strategies that promote long-term adherence to exercise programmes. In addition, adequately powered head-to-head trials comparing different exercise modalities are required to clarify whether specific forms of exercise provide clinically meaningful advantages over others (Li et al., 2024; Miller et al., 2020).

Finally, future trials should improve the reporting of adherence, adverse events, and implementation outcomes to better inform clinical practice and support the integration of exercise into routine care for older adults with depression (Catalan-Matamoros et al., 2016).

### 5. Conclusions

The results support structured exercise as an effective non-pharmacological intervention for reducing depressive symptoms in older adults. In addition, higher levels of habitual physical activity are associated with a lower risk of developing depressive symptoms, supporting the importance of physical activity across both the prevention and treatment of late-life depression (Bizzozero-Peroni et al., 2024; Maier et al., 2021; Schuch et al., 2016).

Although the evidence does not support the superiority of a single exercise modality, structured exercise programmes should be considered as an important component of comprehensive depression management in older adults. Exercise prescriptions should be individualised to maximise long-term participation, as higher intervention adherence has been associated with greater improvements in depressive symptoms (Cheng et al., 2025; Huang et al., 2025; Miller et al., 2020).

Further high-quality randomised controlled trials are needed to define optimal exercise recommendations, including studies with longer intervention periods, improved standardisation of exercise interventions, and comprehensive assessments of adherence and safety outcomes (Catalan-Matamoros et al., 2016; Huang et al., 2025).

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