Effectiveness of physical activity interventions for improving depression, anxiety and distress: an overview of systematic reviews

Ben Singh, Timothy Olds, Rachel Curtis, Dorothea Dumuid, Rosa Virgara, Amanda Watson, Kimberley Szeto, Edward O’Connor, Ty Ferguson, Emily Egilis, Aaron Miatke, Catherine EM Simpson, Carol Maher

ABSTRACT
Objective To synthesise the evidence on the effects of physical activity on symptoms of depression, anxiety and psychological distress in adult populations.
Design Umbrella review.
Data sources Twelve electronic databases were searched for eligible studies published from inception to 1 January 2022.
Eligibility criteria for selecting studies Systematic reviews with meta-analyses of randomised controlled trials designed to increase physical activity in an adult population and that assessed depression, anxiety or psychological distress were eligible. Study selection was undertaken in duplicate by two independent reviewers.
Results Ninety-seven reviews (1039 trials and 128,119 participants) were included.Populations included healthy adults, people with mental health disorders and people with various chronic diseases. Most reviews (n=77) had a critically low A Measurment Tool to Assess systematic Reviews score. Physical activity had medium effects on depression (median effect size=−0.43, IQR=−0.66 to −0.27), anxiety (median effect size=−0.42, IQR=−0.66 to −0.26) and psychological distress (effect size=−0.60, 95% CI=−0.78 to −0.42), compared with usual care across all populations. The largest benefits were seen in people with depression, HIV and kidney disease, in pregnant and postpartum women, and in healthy individuals. Higher intensity physical activity was associated with greater improvements in symptoms. Effectiveness of physical activity interventions diminished with longer duration interventions.
Conclusion and relevance Physical activity is highly beneficial for improving symptoms of depression, anxiety and distress across a wide range of adult populations, including the general population, people with diagnosed mental health disorders and people with chronic disease. Physical activity should be a mainstay approach in the management of depression, anxiety and psychological distress.
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INTRODUCTION
Mental health disorders are among the leading causes of the global health-related burden, with substantial individual and societal costs. In 2019, one in eight people (970 million) worldwide were affected by a mental health disorder and almost one in two (44%) will experience a mental health disorder in their lifetime. The annual global costs of mental health disorders have been estimated at $2.5 trillion (USD), which is projected to increase to $6 trillion (USD) by 2030. Depression is the leading cause of mental health-related disease burden, while anxiety is the most prevalent mental health disorder. Additionally, the COVID-19 pandemic has been associated with increased rates of psychological distress, with prevalence ranging between 35% and 38% worldwide.

The role of lifestyle management approaches, such as exercise, sleep hygiene and a healthy diet, varies between clinical practice guidelines in different countries. In US clinical guidelines, psychotherapy or pharmacotherapy is recommended as the initial treatment approaches, with lifestyle approaches considered as ‘complementary alternative treatments’ where psychotherapy and pharmacotherapy are ‘ineffective or unacceptable’. In other countries such as Australia, lifestyle management is recommended as the first-line treatment approach, thought in practice, pharmacotherapy is often provided first.

There have been hundreds of research trials examining the effects of physical activity (PA) on depression, anxiety and psychological distress, many of which suggest that PA may have similar effects to psychotherapy and pharmacotherapy (and with numerous advantages over psychotherapy and pharmacotherapy, in terms of cost, side-effects and ancillary health benefits). Despite the evidence for the benefits of PA, it has not been widely adopted therapeutically. Patient resistance, the difficulty of prescribing and monitoring PA in clinical settings, as well as the huge volume of largely incommensurable studies, have probably impeded a wider take-up in practice.

Meta-reviews are systematic reviews of systematic reviews, offering a way of synthesising a vast evidence base. While there have been several meta-reviews of PA for depression, anxiety and psychological distress, they have focused on specific population subgroups, particular conditions (eg, depression only) or on particular forms of PA. We set out to undertake the most comprehensive synthesis to date of evidence regarding the effects of all modes of PA on symptoms of depression, anxiety and psychological distress in adult populations.

METHODS
Protocol and registration
The protocol for this systematic umbrella review was prospectively registered on PROSPERO and results are reported according to Preferred
Selecting reviewers (BS and AM, AW, CEMS, DD, EE, EO, KS, RC, RV or TF) in the umbrella review included entirely unique RCTs. The following cut-offs were used to quantify the CCA: 0%–5% = 'slight overlap'; 6%–10% = 'moderate'; 11%–15% = 'high' and >15% = 'very high' overlap. Publication bias was assessed by creating a funnel plot and observing the presence of asymmetries or missing sections.

Meta-analysis results from each review were presented using forest plots. Separate forest plots were created for meta-analyses reporting standardised (eg, standardised mean difference, SMD) and unstandardised effect sizes (eg, mean difference). For meta-analyses that reported standardised effect sizes, we undertook subgroup analyses for clinical status and intervention characteristics. Meta-analysis results were summarised using medians and IQRs.

The Oxford Centre for Evidence-Based Medicine levels of evidence and grades for recommendations were used to classify the overall level of evidence as grade A: consistent level 1 studies (ie, systematic reviews of RCTs or individual RCTs); B: consistent level 2 (ie, systematic reviews of cohort studies or individual cohort studies) or level 3 studies (ie, systematic reviews of case-control studies or individual case-control studies) or extrapolations from level 1 studies; C: level 4 studies (ie, case series) or extrapolations from level 2 or 3 studies or D: level 5 (ie, expert opinion without explicit critical appraisal) evidence or troublingly inconsistent or inconclusive studies of any level.

RESULTS

Of the 1280 records identified, 97 were eligible. They included 1039 unique (component) RCTs and the CCA was 0.66%, indicating slight overlap (see online supplemental eFigure 1 for PRISMA flowchart, including reasons for exclusions). Evaluation of funnel plots indicated no evidence of publication bias (online supplemental eFigure 2).

An overview of all reviews’ characteristics is shown in online supplemental eTable 2. There was a total of >128 119 participants (n=1039) and missing sections.31

Meta-analysis results: depression

Results from 72 meta-analyses based on SMD (n=875 component RCTs, >62 040 participants) showed a medium effect in...
favour of PA for reducing depression and depressive symptoms (median SMD = −0.43, IQR = −0.66 to −0.27, figure 1).

MD effect size for each instrument was: profile of mood states: −7.68 (1 review), Beck Depression Inventory: −5.53 (IQR = −6.24 to −4.81), The Edinburgh Postnatal Depression Scale: −2.97 (IQR = −3.49 to −2.44), self-rating scale: −3.99 (one review), Centre for Epidemiological Studies Depression: −0.36 (IQR = −1.25 to 0.02), Montgomery-Asberg Depression Rating Scale: −1.80 and Hospital Anxiety and Depression Scale: −1.26 (IQR = −1.41 to −1.18, online supplemental eFigure 3 and online supplemental eTable 4).

Grade of recommendation: (A) Consistent level 1 studies.

**Anxiety**

Results from 28 meta-analyses using SMD (171 component RCTs, >10 952 participants) showed a medium effect of PA for reducing anxiety (median SMD = −0.42, IQR = −0.66 to −0.26, figure 2).

MD effect sizes for each instrument were: The State-Trait Anxiety Inventory: −3.61 (IQR = −5.01 to −2.21), Brief Symptom Inventory-18: −5.45 (1 review), Self-rating scale: −4.57 (1 review), Hospital Anxiety and Depression Scale: −1.26 (IQR = −1.26 to −0.79, online supplemental eTable 4 and online supplemental eFigure 5).

Grade of recommendation: (A) Consistent level 1 studies.

**Psychological distress**

One systematic review reported SMD results for psychological distress (six component RCTs, 508 participants), while another systematic review reported MD results (one component RCT, 39 participants). Results showed a medium effect in favour of PA, compared with usual care (SMD = −0.60, 95% CI −0.78 to −0.42). For MD, findings showed no significant effect (MD = −0.30, 95% CI −5.55, 4.95, one review, one component RCT, 39 participants).

Grade of recommendation: (B) Consistent level 2 or 3 studies or extrapolations from level 1 studies.
Subgroup analyses: clinical status

Depression
Seventeen reviews provided data on patients with cancer,45 47–62 and 16 on people with depression or depressive symptoms.10 33 39 63–75 PA was effective in reducing depressive symptoms across all conditions (median SMD range: –0.85 (kidney disease), –0.16 (cardiovascular disease)). The largest effects were found in kidney disease, HIV, chronic obstructive pulmonary disease, generally healthy adults and individuals diagnosed with depression (table 2).

Anxiety
PA was generally effective for reducing anxiety across disease conditions, with median SMDs ranging from –1.23 (HIV) to –0.16 (multiple sclerosis). However, the evidence base was limited except for cancer and anxiety disorders (table 3).

Exercise mode

Depression
Eighteen reviews43 34 37 39 42 51 57 58 60 61 72–74 76–80 reported analyses by exercise mode (310 component RCTs, >14 496 participants, online supplemental eFigure 6). All modes were effective, and median effect sizes (SMDs) were similar across modes: –0.64 (IQR=–0.86 to –0.40) for strength-based interventions (nine reviews); –0.47 (IQR=–0.64 to –0.29) for mixed-mode interventions (12 reviews); –0.46 (IQR=–0.77 to –0.33) for stretching, yoga and other mind–body modalities (11 reviews) and –0.45 (IQR=–0.79 to –0.37) for aerobic exercise (15 reviews).

Anxiety
Fifteen reviews44 45 48 51 58 60 61 78 79 81–86 reported analyses by exercise mode (115 component RCTs, >5 451 participants, online supplemental eFigure 7). All modes were effective, with median SMDs of –0.23 (IQR=–0.37 to –0.08) for strength-based interventions (two reviews); –0.35 (IQR=–0.86 to –0.23) for mixed modes (four reviews); –0.42 (IQR=–0.78 to –0.16) for stretching, yoga, and other mind-body modalities (seven reviews) and –0.29 (IQR=–0.54, –0.16) for aerobic exercise (six reviews).

Exercise intensity

Depression
Five reviews21 42 58 73 74 reported analyses by exercise intensity (63 component RCTs, >2 776 participants, online supplemental eFigure 8). Low, moderate and high-intensity exercise interventions had a median SMD of –0.22 (IQR=–0.50 to –0.12), –0.56 (IQR=–1.03 to –0.33) and –0.70 (IQR=–1.25 to –0.24), respectively.

Anxiety
Two reviews58 84 reported analyses by exercise intensity (23 component RCTs, online supplemental eFigure 9). All intensities were effective. The single review for low-intensity exercise had a median SMD of –0.26; the one for moderate-intensity exercise –0.47, and the two for high-intensity exercise –0.44 (IQR=–0.49 to –0.13).

Intervention duration

Depression
Twelve reviews38 42 56 57 60 61 65 68 69 78 80 reported analyses by intervention duration (166 component RCTs, 15 669 participants, online supplemental eFigure 10). All durations were effective, but effectiveness declined as intervention duration increased. The median SMDs for short (≤12 weeks, 12 reviews), medium (12–23 weeks, 11 reviews) and long duration (≥24 weeks, 4 reviews) interventions were –0.84 (IQR=–1.50 to –0.48), –0.46 (IQR=–0.53 to –0.25) and –0.28 (IQR=–1.15 to –0.17), respectively.

Anxiety
Four reviews56 60 61 78 reported analyses by intervention duration (38 component RCTs, 2 325 participants, online supplemental eFigure 11). Median SMDs for short (12 weeks) and medium-duration (12–23 weeks) interventions were –0.55 (IQR=–0.83 to –0.27) and –0.47 (IQR=–0.72 to –0.08), respectively. The single review reporting on longer interventions (≥24 weeks) reported a median SMD of –0.15.

Weekly duration

Depression
Four reviews42 44 57 58 presented analyses by weekly session duration (68 component RCTs, >5 016 participants, online supplemental eFigure 12). The median SMD for ≤150 min/week and >150 min/week was –0.58 (IQR=–0.77 to –0.30) and –0.29 (IQR=–0.40 to –0.07), respectively.

Anxiety
One review58 provided analyses by weekly session duration (17 component RCTs, online supplemental eFigure 13). The median SMDs for <150 min/week and ≥150 min/week were –1.23 and –0.99, respectively.

Session frequency

Depression
Three reviews42 76 78 reported analyses by session frequency. High-frequency (5–7 sessions per week), moderate-frequency (4–5 per week) and low-frequency (<4 per week) interventions had a median SMD of –0.76 (IQR=–1.20 to –0.32), –1.12 (–1.39 to –0.85) and –0.47 (IQR=–0.59 to –0.35), respectively (online supplemental eFigure 14).
Anxiety
One review\textsuperscript{78} compared session frequency, with SMDs of $-0.50$, $-0.96$ and $-0.52$ for 2–3, 4–5 and 6–7 session per week, respectively (online supplemental eFigure 13).

Table 2  Summary data on the effects of physical activity interventions on depression for a range of clinical conditions, including the number of reviews, studies and participants covered; and the 25th percentile, median and 75th percentile for standardised mean differences

<table>
<thead>
<tr>
<th>Condition</th>
<th>Reviews</th>
<th>RCTs*</th>
<th>Participants†</th>
<th>Standardised mean difference</th>
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<td>2755</td>
<td>$-0.69$</td>
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</table>

*Reviews may have included overlapping randomised controlled trials.
†Randomised controlled trials may have included overlapping participants.
RCTs, randomised controlled trials.

Disruption
This is the first ever study to compile the extensive base of evidence regarding the effects of PA on depression, anxiety and psychological distress. We identified 97 systematic reviews, reporting the findings of 1039 unique RCTs, involving 128,119 participants. Findings suggest that PA interventions are effective in improving symptoms of depression and anxiety. Improvements were observed across all clinical populations, though the
magnitude of effect varied across different clinical populations. The greatest benefits were seen in people with depression, pregnant and postpartum women, apparently healthy individuals and individuals diagnosed with HIV or kidney disease. All PA modes were effective, and higher intensity exercise was associated with greater improvements for depression and anxiety. Longer duration interventions had smaller effects compared with short and mid-duration, though the longest duration interventions still had positive effects.

PA was effective at reducing depression and anxiety across all clinical conditions, though the magnitude of the benefit varied between clinical groups. The larger effect sizes observed in clinical populations may reflect that these populations experience above-average symptoms of depression and anxiety and have low PA levels, and, therefore, have a greater scope for improvement compared with non-clinical populations.17

All PA modes were beneficial, including aerobic, resistance, mixed-mode exercise and yoga. It is likely that the beneficial effects of PA on depression and anxiety are due to a combination of various psychological, neurophysiological and social mechanisms.87 Different modes of PA stimulate different physiological88 and psychosocial effects,88–90 and this was supported by our findings (eg, resistance exercise had the largest effects on depression, while Yoga and other mind–body exercises were most effective for reducing anxiety). Furthermore, our findings showed that moderate-intensity and high-intensity PA modes were more effective than lower intensities. PA improves depression though various neuromolecular mechanisms including increased expression of neurotrophic factors, increased availability of serotonin and norepinephrine, regulation of hypothalamic–pituitary–adrenal axis activity and reduced systemic inflammation.91 92 Therefore, low-intensity PA may be insufficient for stimulating the neurological and hormonal changes that are associated with larger improvements in depression and anxiety.97 Overall, our findings add further support to public health guidelines, which recommend multimodal, moderate and vigorous intensity PA.

Our findings that longer duration interventions were less effective than shorter interventions may seem counter intuitive. It is possible that this finding reflects a decline in adherence with longer interventions. Furthermore, due to a lack of blinding of participants in PA trials, participants may have expected to have improved symptoms. It is possible that after experiencing short-term improvements in depression or anxiety, the expectancy effect may diminish over longer periods of time. An alternative explanation is that the longer interventions might not provide sufficient progression of PA dose, leading to a reduction in their effectiveness. Furthermore, it was somewhat surprising that smaller weekly duration interventions demonstrated larger effects than higher weekly duration. This is the opposite to the dose–benefit relationship observed for exercise and physical health outcomes.93 It is possible that shorter duration interventions are easier for participants to comply with, whereas longer weekly duration interventions are more burdensome and that may be impacting the psychological benefits. It is a useful message that interventions do not need to provide high doses of PA for improvements in depression.

The key strength of this study was that it is the first umbrella review to evaluate the effects of all types of PA on depression, anxiety and psychological distress in all adult populations. We included only the highest level of evidence: meta-analyses of RCTs and applied stringent criteria regarding the design of the component RCTs to ensure that effects could be confidently attributed to PA rather than other intervention components. Additionally, there was only slight overlap in the component RCTs, increasing our confidence in the findings.

A limitation of the review is that most evidence focused on mild-to-moderate depression, with fewer reviews addressing anxiety and psychological distress, preventing us from reaching

<table>
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<th>Participants†</th>
<th>Standardised mean difference</th>
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<td>4</td>
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<td>–0.16</td>
</tr>
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</table>

*Reviews may have included overlapping randomised controlled trials. †Randomised controlled trials may have included overlapping participants.
firm conclusions in the subgroup analyses for these outcomes. Furthermore, most (n=77) of the included reviews were rated as ‘critically low’, based on the AMSTAR-2 quality rating.

Clinical implications
PA is effective for managing symptoms of depression and anxiety across numerous populations, including the general population, people with mental illnesses and various other clinical populations. While the benefit of exercise for depression and anxiety is generally recognised, it is often overlooked in the management of these conditions. Furthermore, many people with depression and anxiety have comorbidities, and PA is beneficial for their mental health and disease management. This underscores the need for PA to be a mainstay approach for managing depression and anxiety.

All modes of PA are effective, with moderate-to-high intensities more effective than low intensity. Larger benefits are achieved from shorter interventions, which has health service delivery cost implications—suggesting that benefits can be obtained following from shorter interventions, which has health service delivery cost implications—suggesting that benefits can be obtained following short-term interventions, and intensive long-term interventions are not necessarily required to achieve therapeutic benefit. The effect size reductions in symptoms of depression (−0.43) and anxiety (−0.42) are comparable to or slightly greater than the effects observed for psychotherapy and pharmacotherapy (SMD range=−0.22 to −0.37).94–97 Future research to understand the relative effectiveness of PA compared with (and in combination with) other treatments is needed to confirm these findings.

In conclusion, PA is effective for improving depression and anxiety across a very wide range of populations. All PA modes are effective, and higher intensity is associated with greater benefit. The findings from this umbrella review underscore the need for PA, including structured exercise interventions, as a mainstay approach for managing depression and anxiety.

What is already known
⇒ Previous research trials suggest that physical activity may have similar effects to psychotherapy and pharmacotherapy for patients with depression, anxiety or psychological distress.
⇒ Studies have evaluated different forms of physical activity, in varying dosages, in different population subgroups, and using different comparator groups, making it difficult for clinicians to understand the body of evidence for physical activity in the management of mental health disorders.

What are the new findings
⇒ Results showed that physical activity is effective for reducing mild-to-moderate symptoms of depression, anxiety and psychological distress (median effect size range=−0.42 to −0.60), compared with usual care across all populations.
⇒ Our findings underscore the important role of physical activity in the management of mild-to-moderate symptoms of depression, anxiety and psychological distress.


Pieper D, Antone S-L, Mathes T, et al. Systematic review finds overlapping reviews were not mentioned in every other overview. *J Clin Epidemiol* 2014;67:368–75.


Review


eTable 1. Medline search strategy and terms

<table>
<thead>
<tr>
<th>MEDLINE(R) ALL &lt;1946 to November 12, 2021&gt;</th>
<th>Ovid MEDLINE(R) ALL &lt;1946 to November 19, 2021&gt;</th>
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<tbody>
<tr>
<td>1  Meta-Analysis as Topic/</td>
<td>34 human/</td>
</tr>
<tr>
<td>2  meta analy$.tw.</td>
<td>35 33 not (33 and 34) 36 or/30-32,35</td>
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<td>3  metaanaly$.tw.</td>
<td>37 9 or 18 or 24 or 29</td>
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<td>4  Meta-Analysis/</td>
<td>38 37 not 36</td>
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<td>5  Systematic Review/ [addition]</td>
<td>39 exp exercise/</td>
</tr>
<tr>
<td>6  Systematic Reviews as Topic/ [addition]</td>
<td>40 exp exercise therapy/</td>
</tr>
<tr>
<td>7  (systematic adj (review$1 or overview$1)).tw.</td>
<td>41 exp sports/</td>
</tr>
<tr>
<td>8  exp Review Literature as Topic/</td>
<td>42 Physical Fitness/</td>
</tr>
<tr>
<td>9  or/1-8</td>
<td>43 (physical* adj5 (fit* or train* or activ* or</td>
</tr>
<tr>
<td>10  cochrane.ab.</td>
<td>endur* or exer*)).ti,ab.</td>
</tr>
<tr>
<td>11  embase.ab.</td>
<td>44 (exercis* adj5 (train* or physical* or</td>
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<tr>
<td>12  (psychlit or psyclit).ab.</td>
<td>activ*)).ti,ab.</td>
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<tr>
<td>13  (psychinfo or psycinfo).ab.</td>
<td>45 sport*.ti,ab.</td>
</tr>
<tr>
<td>14  (cinahl or cinhal).ab.</td>
<td>46 walk*.ti,ab.</td>
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<tr>
<td>15  science citation index.ab.</td>
<td>47 swim*.ti,ab.</td>
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<td>16  bids.ab.</td>
<td>48 pilates.ti,ab.</td>
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<td>17  cancercrit.ab.</td>
<td>49 step*.ti,ab.</td>
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<td>18  or/10-17</td>
<td>50 HIIT.ti,ab.</td>
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<td>19  reference list$1.ab.</td>
<td>51 (tai ji or tai chi or tai-ji or tai-chi).ti,ab.</td>
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<td>20  bibliography$1.ab.</td>
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<td>21  hand-search$1.ab.</td>
<td>53 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46</td>
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<td>22  relevant journals.ab.</td>
<td>54 or 47 or 48 or 49 or 50 or 51 or 52</td>
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<td>23  manual search$1.ab.</td>
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<td>24  or/19-23</td>
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<td>25  selection criteria.ab.</td>
<td>57 anxiety.ti,ab.</td>
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<tr>
<td>26  data extraction.ab.</td>
<td>58 distress.ti,ab.</td>
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<td>27  25 or 26</td>
<td>59 55 or 56 or 57</td>
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<td>28  Review/</td>
<td>60 54 and 58</td>
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<td>29  27 and 28</td>
<td>61 food.ti,ab.</td>
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<td>30  Comment/</td>
<td>62 diet*.ti,ab.</td>
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<td>31  Letter/</td>
<td>63 nurtri*.ti,ab.</td>
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<td>32  Editorial/</td>
<td>64 59 not (60 or 61 or 62)</td>
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<td>33  animal/</td>
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eFigure 1. PRISMA flow diagram.
eFigure 2. Funnel plot showing the relationship between systematic review-level standardised mean differences and the number of studies included in each meta-analysis for depression and anxiety.
Table 2. Overview of all included studies.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Studies (n=)</th>
<th>Total sample (n=)</th>
<th>Population or condition; gender; age mean±SD or range (years)</th>
<th>Main interventions; intensity; duration (range).</th>
<th>Relevant outcomes (instruments)</th>
<th>AMSTAR category</th>
</tr>
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<tbody>
<tr>
<td>Adamson 2015</td>
<td>26</td>
<td>1324</td>
<td>Neurological disorders; males and females; mean±SD and range NR</td>
<td>AE, RE, Yoga, Tai Chi, Qigong, gymnastics; various intensities; 4w-52w</td>
<td>1) Depression (BDI, BDI-II, CES-D, CESD-10, CSDD, GDS, HADS, IDS-SR, Levine-Pilowsky depression questionnaire, MADRS, MDI, POMS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Aylett 2018</td>
<td>15</td>
<td>675</td>
<td>Anxiety; males and females; mean±SD and range NR</td>
<td>AE, RE; various intensities; 2w-10w</td>
<td>1) Anxiety (PSWQ, Liebowitz Social scale, Anxiety Sensitivity Index, BAI, STAI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Barreto 2015</td>
<td>20</td>
<td>1627</td>
<td>Dementia; males and females; mean±SD and range NR</td>
<td>AE, RE, Tai Chi, dance; various intensities; 6w-1y</td>
<td>1) Depression (GDS-15, GDS-30, MADRS, GSDD)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Bellón 2021</td>
<td>14</td>
<td>1737</td>
<td>Adults without depression; males and females; 44.7±18.6</td>
<td>AE, RE, Yoga; various intensities; 4w-2y</td>
<td>1) Depression (HADS, PHQ-9, BDI, SCID-I, EPDS, POMS, CES-D, BDI-FS, GDS, BDI-II)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Bergenthal 2014</td>
<td>9</td>
<td>818</td>
<td>Haematological cancer; males and females; 50.7±2.4</td>
<td>AE, RE; various intensities; 10d-36w</td>
<td>1) Depression (not specified)</td>
<td>High</td>
</tr>
<tr>
<td>Bradt 2015</td>
<td>3</td>
<td>207</td>
<td>Breast cancer; females; 55.4±4.8</td>
<td>Dance; various intensities; 3w-12w</td>
<td>1) Depression (POMS, HADS)</td>
<td>High</td>
</tr>
<tr>
<td>Bridle 2012</td>
<td>9</td>
<td>667</td>
<td>Older adults with depression; males and females; 75.7±6.8</td>
<td>AE, RE, Tai Chi, Qigong; various intensities; 12w-1y</td>
<td>1) Depression (PHQ-9, GDS, HSCL-20, CES-D, HDRS, BDI, GSDD)</td>
<td>Low</td>
</tr>
<tr>
<td>Brinsley 2020</td>
<td>19</td>
<td>1080</td>
<td>Mental disorders; males and females; 38.5±9.4</td>
<td>Yoga; various intensities; 5w-12w</td>
<td>1) Depression (PANSS, HDRS, CES-D, HAD-C, FBGL, DASS-21, CDS, BDI, CAPS, HAM-D-21, QIDS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Broderick 2015</td>
<td>8</td>
<td>457</td>
<td>Schizophrenia; males and females; mean±SD and range NR</td>
<td>Yoga; various intensities; 5w-16w</td>
<td>1) Depression (Calgary Depression Scale)</td>
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<tr>
<td>Brown 2012</td>
<td>40</td>
<td>2929</td>
<td>Cancer; males and females; 51.3±6.5</td>
<td>AE, RE, Yoga; various intensities; 3w-1y</td>
<td>1) CES-D, Center for Epidemiologic Studies Depression scale; POMS, Profile of Mood States; BDI, Beck Depression Inventory; HADS, Hospital Anxiety and Depression Scale; Symptom Assessment Scale.</td>
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<tr>
<td>Carneiro 2020</td>
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<td>295</td>
<td>Depression; males and females; 61.1±14.4</td>
<td>RE; various intensities; 10w-16w</td>
<td>1) Depression (HAM-D, CES-D, GDS, BDI)</td>
<td>Low</td>
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<tr>
<td>Carter 2019</td>
<td>18</td>
<td>1428</td>
<td>Postnatal women; females; 29.3±2.9</td>
<td>AE, RE; various intensities; 6w-14m</td>
<td>1) Depression (DASS, EPDS, GHRQ12, HDRS, IDAS, PHQ, SCID, SF-36, HAM-D, SCID-PN diagnosis, SF-36v2, CES-D, PHQ-9, SCID-I)</td>
<td>Low</td>
</tr>
<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range).</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<tr>
<td>Chi 2013</td>
<td>4</td>
<td>253</td>
<td>Older adults with depressive symptoms; males and females; mean±SD NR; age range=52-82</td>
<td>Tai Chi; low-intensity; 12w-24w</td>
<td>1) Depression (DASS-21, CES-D)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Choo 2020</td>
<td>13</td>
<td>869</td>
<td>Chronic diseases; males and females; 67.2±3.5</td>
<td>Tai Chi; low-intensity; 10w-24w</td>
<td>1) Depression (CES-D, Zung depression scale, Depression, Anxiety, and Stress Scales)</td>
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<td>Chung 2017</td>
<td>17</td>
<td>651</td>
<td>End Stage Renal Disease; males and females; mean±SD and range NR</td>
<td>AE, RE; various intensities; 8w-48w</td>
<td>1) Depression (Zung depression scale, BDI, SF-36)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Cooney 2013</td>
<td>59</td>
<td>2326</td>
<td>Depression; males and females; 52.7±19.3</td>
<td>AE, RE; various intensities; 10d-16w</td>
<td>1) Depression (Hamilton Rating Scale for Depression, BDI, BDI-II, Lubin’s Depression Adjective List, Zung Depression Scale, MADRS, HAM-D, Global Assessment Scale, CES-D, POMS, Cornell Scale for Depression in Dementia, GDS)</td>
<td>High</td>
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<tr>
<td>Coventry 2007</td>
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<td>545</td>
<td>COPD; males and females; 65.3±2.9</td>
<td>AE, RE; various intensities; 5w-1y</td>
<td>1) Depression (HADS, Lorr-McNair Mood Questionnaire, CES-D, SCL-90-R)</td>
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</tr>
<tr>
<td>Craft 2012</td>
<td>15</td>
<td>1371</td>
<td>Cancer; males and females; 55.1±7.8</td>
<td>AE, RE; various intensities; 6w-6m</td>
<td>1) Depression (CES-D Short Form, CES-D, BDI-II, HADS)</td>
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<tr>
<td>Dalgas 2015</td>
<td>15</td>
<td>591</td>
<td>Multiple sclerosis; males and females; 46.7±6.3</td>
<td>AE, RE, water aerobics, yoga, sports climbing; various intensities; 3w-26w</td>
<td>1) Depression (BDI-I, BDI-II HADS-D, MDI, CES-D, IDS-SR30, POMS)</td>
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</tr>
<tr>
<td>deAlmeida 2020</td>
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<td>1129</td>
<td>Dementia; males and females; 77.3±7.3</td>
<td>AE, RE; various intensities; 6w-2y</td>
<td>1) Depression (Cornell Scale for Depression in Dementia, NPI Depression, GDS – Short Form)</td>
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</tr>
<tr>
<td>Duan 2020</td>
<td>15</td>
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<td>Cancer; males and females; 54.6±6.6</td>
<td>Yoga, Qigong, Tai Chi, Dance; various intensities; 3w-24w</td>
<td>1) Depression (HADS, BDI, CES-D, PHQ-9)</td>
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<td>Eng 2014</td>
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<td>1022</td>
<td>Stroke; males and females; mean±SD NR; age range=21-91</td>
<td>AE, RE; various intensities; 4-12w</td>
<td>1) Depression (HADS, GDS, BDI, CES-D)</td>
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<tr>
<td>Ensari 2014</td>
<td>13</td>
<td>477</td>
<td>Multiple sclerosis; males and females; 45.1±5.8</td>
<td>AE, RE, water aerobics, yoga; various intensities; 4-26w</td>
<td>1) Depression (BFI, IFD, MDI, BDI-II, HADS, CES-D, POMS, POMS-SF)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range)</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<td>Felbel 2014</td>
<td>1</td>
<td>39</td>
<td>Haematological cancer; males and females; 51</td>
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<td>Kidney disease; males and females; 51.7±8.6</td>
<td>AE, RE, Pilates, intradialytic exercise; various intensities; 4w-48w</td>
<td>1) Depression (HADS, DASS, BDI, General Health Dimensions - depression subscale) 2) Anxiety (HADS, DASS)</td>
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<td>Fong 2012</td>
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<td>4113</td>
<td>Cancer; males and females; 55.7±5.8</td>
<td>AE, RE, Yoga; various intensities; 3w-60w</td>
<td>1) Depression (HADS, BDI) 2) Anxiety (HADS)</td>
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<td>Forbes 2008</td>
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<td>280</td>
<td>Dementia; males and females; mean±SD and range NR</td>
<td>AE, RE; various intensities; 2w-1y</td>
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<tr>
<td>Furmaniak 2016</td>
<td>32</td>
<td>2626</td>
<td>Breast cancer; females; mean±SD and range NR</td>
<td>AE, RE; various intensities; 6w-1y</td>
<td>1) Depression (BDI, CES-D, HADS) 2) Anxiety (STAI, HADS)</td>
<td>High</td>
</tr>
<tr>
<td>Gascoyne 2020</td>
<td>4</td>
<td>133</td>
<td>Multiple sclerosis; males and females; 43.9±7.6</td>
<td>AE, RE; various intensities; 8w-26w</td>
<td>1) Anxiety (POMS, HADS, STAI, BAI)</td>
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</tr>
<tr>
<td>Gong 2015</td>
<td>6</td>
<td>375</td>
<td>Pregnant women; females only; mean±SD NR; range = 18-40</td>
<td>Yoga; various intensities; 12w-16w</td>
<td>1) Depression (CES-D, HADS, EPDS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Gordon 2018</td>
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<td>1877</td>
<td>Adults with or without chronic conditions; males and females; 52±18</td>
<td>RE; various intensities; 6w-1y</td>
<td></td>
<td>Critically low</td>
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<td>Gouw 2019</td>
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<td>1340</td>
<td>Older adults with chronic disease; males and females; 70.4±6.2</td>
<td>Qigong; low intensity; 8w-26w</td>
<td>1) Depression (GDS, HADS, HRSD, Self-rating scale)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Guo 2020</td>
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<td>1096</td>
<td>COPD; males and females; 67.4±4.9</td>
<td>Tai Chi; various intensities; 2w-1y</td>
<td>1) Depression (HADS, Self-rating scale) 2) Anxiety (HADS, Self-rating scale)</td>
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<td>Hall 2021</td>
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<td>Knee osteoarthritis; males and females; 65.9±4.6</td>
<td>AE, RE, Yoga, Tai chi, Qigong; various intensities; 6w-1y</td>
<td>1) Depression (HADS, CES-D) 2) Anxiety (HADS)</td>
<td>Critically low</td>
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<td>Heinzel 2015</td>
<td>18</td>
<td>1063</td>
<td>Older adults; males and females; 71.9±6.0</td>
<td>AE, RE, Tai chi, Qigong; various intensities; 6w-26w</td>
<td>1) Depression (HADS, HDG, HAM-D, PHQ-9, BDI, DSM-IV diagnostic criteria)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Heissel 2019</td>
<td>10</td>
<td>479</td>
<td>HIV; males and females; mean±SD and range NR</td>
<td>AE, RE, Yoga; various intensities; 4w-12w</td>
<td>1) Depression (BDI, GHQ-28, POMS, HADS) 2) Anxiety (GHQ-28, POMS, HADS, STAI)</td>
<td>High</td>
</tr>
<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range).</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<tr>
<td>Herring 2017</td>
<td>14</td>
<td>624</td>
<td>Multiple Sclerosis; males and females; 44±6.6</td>
<td>AE, RE, Yoga; various intensities; 3w-26w</td>
<td>1) Depression (BDI, CES-D, HADS, IDS-SR, POMS, MDI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Josefsson 2014</td>
<td>15</td>
<td>880</td>
<td>Depression; males and females; 46.3±13</td>
<td>AE, RE; various intensities; 4w-16w</td>
<td>1) Depression (HRSD, BDI, MADS, PHQ-9, MMPI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Kelley 2018</td>
<td>14</td>
<td>926</td>
<td>Arthritis and rheumatic diseases; males and females; 54.5±8.9</td>
<td>AE; RE; various intensities; 8w-32w</td>
<td>1) Depression (AIMS, BDI, CES-D, DASS-21, FIQ, HADS, MHI, VAS)</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2) Anxiety (STAI, AIMS, HADS, DASS-21, MHI, FIQ, VAS)</td>
<td></td>
</tr>
<tr>
<td>Kelley 2015</td>
<td>29</td>
<td>2449</td>
<td>Depression; males and females; 52.3±9.7</td>
<td>AE, RE, Tai Chi, Qi Gong; various intensities; 4w-32w</td>
<td>1) Depression (BDI, CES-D, DASS-21, MIH, FIQ, AIMS, POMS, HADS, VAS)</td>
<td>High</td>
</tr>
<tr>
<td>Krogh 2017</td>
<td>35</td>
<td>2498</td>
<td>Depression; males and females; 44±12.8</td>
<td>AE; RE; various intensities; 2w-32w</td>
<td>1) Depression (HAM-D17, SCL-D, BDI, MADRS, PHQ-9)</td>
<td>Low</td>
</tr>
<tr>
<td>Kvam 2016</td>
<td>23</td>
<td>977</td>
<td>Depression; males and females; 36.9±14.4</td>
<td>AE; RE; various intensities; 1w-8m</td>
<td>1) Depression (HAM-D-17, MDD, BDI, BDI-II, SCL-90)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Lawlor 2001</td>
<td>14</td>
<td>479</td>
<td>Depression; males and females; 44.7±17</td>
<td>AE; RE; various intensities; 4w-12w</td>
<td>1) Depression (BDI, Depression symptom checklist)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Lawrence 2017</td>
<td>2</td>
<td>72</td>
<td>Stroke; males and females; 59.5±4.6</td>
<td>Yoga; various intensities; 8w-10w</td>
<td>1) Depression (GDS15)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Lee 2021</td>
<td>22</td>
<td>1025</td>
<td>Depression; males and females; 48.5±12.6</td>
<td>AE; RE; various intensities; 10d-24w</td>
<td>1) Depression (BDI-II, HAM-D, BDI, MADRS, MARD-S, BRMS, GDS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Lee 2020</td>
<td>29</td>
<td>2989</td>
<td>Breast cancer; females; 50±7.7</td>
<td>AE; RE; Yoga; various intensities; 4w-26w</td>
<td>1) Depression (HADS, CES-D)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Leng 2018</td>
<td>21</td>
<td>2589</td>
<td>Cognitive impairment; males and females; 76.3±5.9</td>
<td>AE, RE, Tai Chi, Yoga; various intensities; 6w-1y</td>
<td>2) Anxiety (HADS, Spielberger State-Anergy Inventory)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Liu 2019</td>
<td>6</td>
<td>429</td>
<td>Lymphoma; males and females; 53.6±5.4</td>
<td>AE, Yoga, Qi Gong; various intensities; 3w-36w</td>
<td>1) Depression (CES-D)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Li 2019</td>
<td>13</td>
<td>906</td>
<td>COPD; males and females; 63.9±6.9</td>
<td>Yoga, Qi Gong, Tai chi, various intensities; 8w-48w</td>
<td>1) Depression (CES-D, SSAI, HADS, BDI, Self-rating scale, HAM)</td>
<td>Critically low</td>
</tr>
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<td></td>
<td>2) Anxiety (HADS, STAI, Self-rating scale, HAMA)</td>
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<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range).</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<tr>
<td>Li 2019</td>
<td>20</td>
<td>2051</td>
<td>Dementia; males and females; 80.9±5.1</td>
<td>AE, RE, dance; various intensities; 6w-18m</td>
<td>1) Depression (HAMD-17, GDS, CSDD, MADRS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Lund 2020</td>
<td>8</td>
<td>552</td>
<td>Colorectal cancer; males and females; 58±6.4</td>
<td>AE, RE; various intensities; 6w-24w</td>
<td>1) Depression (HADS, BDI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Lyu 2021</td>
<td>11</td>
<td>732</td>
<td>Stroke patients with mental or sleep disorders; males and females; 62.2±6.6</td>
<td>Tai Chi; low intensity; 6w-24w</td>
<td>1) Depression (CES-D, HAM-D, BDI)</td>
<td>Critically low</td>
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<td>2) Anxiety (HAMA)</td>
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<tr>
<td>McCurdy 2017</td>
<td>16</td>
<td>1327</td>
<td>Postpartum women, females; 29.6±2.8</td>
<td>AE, RE, Yoga; various intensities; 6w-1y</td>
<td>1) Depression (EPDS, CES-D, HAMD)</td>
<td>Critically low</td>
</tr>
<tr>
<td>McGettigan 2020</td>
<td>16</td>
<td>992</td>
<td>Colorectal cancer; males and females; 59.5±4.6</td>
<td>AE, RE; various intensities; 6w-1y</td>
<td>1) Depression (HADS, CES-D)</td>
<td>Low</td>
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<td>2) Anxiety (HADS, STAI)</td>
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<tr>
<td>McGranahan 2021</td>
<td>4</td>
<td>149</td>
<td>PTSD; males and females; 44.7±16.3</td>
<td>AE, RE; various intensities; 3w-12w</td>
<td>1) Depression (CES-D, DASS, PHD)</td>
<td>Critically low</td>
</tr>
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<td>2) Anxiety (STAI, DASS)</td>
<td></td>
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<tr>
<td>Miller 2020</td>
<td>69</td>
<td>5379</td>
<td>Older adults; males and females; 73.4±5.6</td>
<td>AE, RE, Yoga, Tai Chi, Qigong; various intensities; 4w-15m</td>
<td>1) Depression (BDI, CESD-20, POMS-D, GDS-15, GDS-30, BDI-II, MADRS, GADS-D, CSDD, TDQ, HADS-D, HRSD, DASS-D, IDS-C, GDS-5, POMS-SF-D, CESD-10, PROMIS-EDD SF-8a, CESD-6)</td>
<td>Low</td>
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<tr>
<td>Miller 2020</td>
<td>15</td>
<td>596</td>
<td>Older adults with depression; males and females; 73.9±5.9</td>
<td>AE, RE, Yoga, Tai Chi, Qigong; various intensities; 4w-16w</td>
<td>1) Depression (GDS-15, CESD-20, GDS-30, HRSD, BDI, CSDD)</td>
<td>Low</td>
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<tr>
<td>Mishra 2012</td>
<td>40</td>
<td>3694</td>
<td>Cancer; males and females; 53.3±5.4</td>
<td>AE, RE, Yoga, Tai Chi, Qigong; various intensities; 3w-1y</td>
<td>1) Depression (CES-D, HADS, BDI, VAS, POMS)</td>
<td>High</td>
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<td>2) Anxiety (HADS, STAI, VAS, POMS)</td>
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<tr>
<td>Morres 2019</td>
<td>11</td>
<td>455</td>
<td>Depression; males and females; Mean (SD) = 37 (9.4); range = 20.9-49.1</td>
<td>AE; various intensities; 10d-32w</td>
<td>1) Depression (HAMD-17, BDI, CIS, MADRS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Nebiker 2018</td>
<td>27</td>
<td>1452</td>
<td>Depression; males and females; 49.5±16.0</td>
<td>AE, RE, Yoga, Tai Chi; various intensities; 10d-32w</td>
<td>1) Depression (BDI, BDI-II, HRSD, CES-D, GDS-15, GDS, HAM-D, MADRS, PHQ-9)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range).</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<tr>
<td>Nixon 2005</td>
<td>10</td>
<td>276</td>
<td>HIV/AIDS; males and females; mean±SD 18-58</td>
<td>AE, RE; various intensities; 5w-24w</td>
<td>1) Depression (POMS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Park 2014</td>
<td>18</td>
<td>3297</td>
<td>Older adults; males and females; mean±SD NR range NR</td>
<td>AE, RE, Yoga, Tai Chi; various intensities; 4w-2y</td>
<td>1) Depression (GDS, GDS-15, HADS, Zung Self-rating depression scale, CES-D)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Patsou 2017</td>
<td>14</td>
<td>1701</td>
<td>Breast cancer; females; 52.1±2.9</td>
<td>AE, RE, Yoga; various intensities; 6-1y</td>
<td>1) Depression (HADS, BDI-II, CES-D, POMS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Pavey 2011</td>
<td>8</td>
<td>5109</td>
<td>Adults; males and females; 59±7</td>
<td>AE; various intensities 8w-52w</td>
<td>1) Depression (not specified)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Pearsall 2014</td>
<td>8</td>
<td>374</td>
<td>Schizophrenia; males and females; mean±SD NR; range 27-52</td>
<td>AE; various intensities 10w-24w</td>
<td>1) Depression (BSI, WHOQOL-BREF-TR, BDI, MHI, CGI-Severity)</td>
<td>Critically low</td>
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<td></td>
<td>2) Anxiety (BSI, WHOQOL-BREF-TR, MHI, CGI-Severity)</td>
<td></td>
</tr>
<tr>
<td>Peddle-McIntyre 2019</td>
<td>6</td>
<td>221</td>
<td>Lung cancer; males and female; 60.9±5.3</td>
<td>AE, RE; various intensities; 4w-12w</td>
<td>1) Depression (GHQ-12, HADS)</td>
<td>Critically low</td>
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<td>2) Anxiety (GHQ-12, HADS)</td>
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<tr>
<td>Pendlan 2021</td>
<td>5</td>
<td>242</td>
<td>Postpartum women; females; 30±3.5</td>
<td>AE; various intensities; 12w-6m</td>
<td>1) Depression (EPDS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Ramachandra n 2021</td>
<td>14</td>
<td>2869</td>
<td>Heart disease; males and females; 59.4±5.7</td>
<td>AE; various intensities; 6w-6m</td>
<td>1) Depression (Patient Health Questionnaire, CES-D, DASS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Ramirez-velez 2021</td>
<td>57</td>
<td>6988</td>
<td>Breast cancer; females; 52.3±3.3</td>
<td>AE, RE; various intensities; 5w-1y</td>
<td>1) Depression (HADs, FACT-B Depression, BDI, Finnish version of modified BDI, CES-D)</td>
<td>Critically low</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>2) Anxiety (HADs, FACT-B Anxiety, Social Physique Anxiety Scale-7, SSSA, State-Trait Anxiety Inventory (STAI))</td>
<td></td>
</tr>
<tr>
<td>Ramos-Sanchez 2021</td>
<td>13</td>
<td>731</td>
<td>Anxiety disorder; males and females; 39.2±11.7</td>
<td>AE, RE; various intensities; 3w-20w</td>
<td>1) Anxiety (Hamilton Scale for Anxiety, Penn State Worry Questionnaire, Anxiety stress scale, Chinese Mandarin version STAI)</td>
<td>High</td>
</tr>
<tr>
<td>Rhyner 2016</td>
<td>41</td>
<td>NR</td>
<td>Older adults; males and females; 73.9±5.2</td>
<td>AE, RE, Yoga, Tai Chi; various intensities; 3w-14w</td>
<td>1) Depression (GSD, CES-D, GSD-15, BDI, Taiwanese Depression Questionnaire, HSCL-20, DASS, HDRS, Cornell Scale for Depression in Dementia, MADRS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range)</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<tr>
<td>Rosenbaum 2015</td>
<td>4</td>
<td>200</td>
<td>PTSD; males and females; 43.7±6.7</td>
<td>AE, RE, Yoga; various intensities; 6w-12w</td>
<td>1) Depression (PSS-I, PCL-C, CAPS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Russ 2021</td>
<td>9</td>
<td>456</td>
<td>Dementia; males and females; 85.5±1</td>
<td>RE; various intensities; 12w-7m</td>
<td>1) Depression (GDS, CCSD, MADRS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Salihu 2021</td>
<td>28</td>
<td>2249</td>
<td>Adults; males and females; 65.3±16</td>
<td>Dance; various intensities; 10d-1y</td>
<td>1) Depression (BDI, GDS, POMS, CESD, HADS, DASS-21) 2) Anxiety (Test Anxiety Inventory, DASS-21, HADS, STAI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Schuch 2016</td>
<td>8</td>
<td>267</td>
<td>Older adults with depression or depressive symptoms; males and females; 69.5±0.71</td>
<td>AE, RE; various intensities; 6w-16w</td>
<td>1) Depression (HAM-D, GDS-15, BDI, GDS, PHQ-9, CES-D, CSDD)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Schuch 2016</td>
<td>25</td>
<td>1487</td>
<td>Depression or depressive symptoms; males and females; 50.9±17.1</td>
<td>AE, RE; various intensities; 4w-32w</td>
<td>1) Depression (HAM-D, BDI, BDI-II, MARSD, GDS-15, CES-D, PHQ-9, DACL, MMPI, CSDD)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Schumacher 2021</td>
<td>7</td>
<td>391</td>
<td>Prostate cancer, males; 67.9±1.5</td>
<td>AE, RE; various intensities; 4w-24w</td>
<td>1) Depression (CES-D, BDI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Singh 2018</td>
<td>61</td>
<td>5200</td>
<td>Breast cancer; females; 51±3.6</td>
<td>AE, RE, Yoga; various intensities; 6w-1y</td>
<td>1) Depression (POMs, HADs, CES-D, Greene Climacteric Scale, NDI, Functional Living Index of Cancer 2) Anxiety (POMs, HADs, STAI, FACT-Anemia, Greene Climacteric Scale, SSAI, Social Physique Anxiety Scale, Functional Living Index of Cancer)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Singh 2020</td>
<td>31</td>
<td>2109</td>
<td>Lung cancer; males and females; 64±3</td>
<td>AE, RE, Yoga; various intensities; 1w-20w</td>
<td>1) Depression (HADs, GHQ) 2) Anxiety (HADs, GHQ)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Stathopoulou 2006</td>
<td>11</td>
<td>513</td>
<td>Depression; males and females; mean±SD and range NR</td>
<td>AE, RE; various intensities; 4w-16w</td>
<td>1) Depression (HRSD, EPSD, BDI, Self-rating scale, Depression - Symptom Checklist 90)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Stubbs 2017</td>
<td>6</td>
<td>262</td>
<td>Anxiety or stress disorder; males and females; 34.7±9.6</td>
<td>AE; various intensities; 6w-12w</td>
<td>1) Anxiety (HAM-A, Penn State Worry Questionnaire, PSWQ, DASS21, PTSD symptom scale, PSSI, PTSD checklist–civilian version)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range)</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<tr>
<td>Tu 2014</td>
<td>19</td>
<td>3447</td>
<td>Heart failure; males and females; 63.7±7.8</td>
<td>AE, RE, Tai Chi; various intensities; 6w-76w</td>
<td>1) Depression (Depression - Symptom Checklist 90, HADS, BDI, BDI-II, MADRS, Multiple Affect Adjective Checklist, GDS, HAM-D, Cognitive Behavioural Assessment Hospital form, CES-D, Psychological General Well-being Index, Hare-Davis Cardiac Depression Scale, POMS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>vanHaren 2013</td>
<td>11</td>
<td>734</td>
<td>Cancer; males and females; mean±SD and range NR</td>
<td>RE, AE; various intensities; 4w-24w</td>
<td>1) Depression (POMS, HADS) 2) Anxiety (POMS, HADS) 3) Distress (Self-perception scale of physical and emotional well-being)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Vashistha 2016</td>
<td>13</td>
<td>1057</td>
<td>Prostate cancer; males; 69.2±2.3</td>
<td>AE, RE, Qigong; various intensities; 4w-6m</td>
<td>1) Depression (BSI-18) 2) Anxiety (BSI-18)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Wang 2014</td>
<td>22</td>
<td>2894</td>
<td>Substance use disorder; males and females; 38.9±5.8</td>
<td>AE, RE, Yoga, Tai Chi, sports; various intensities; 10d-6m</td>
<td>1) Depression (BDI, CES-D, Self-rating depression scale, HADS) 2) Anxiety (Self-rating scale, Hamilton Anxiety Scores, Mood and Physical Symptoms Scale-anxiety, STAI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Wang 2019</td>
<td>12</td>
<td>516</td>
<td>Heart failure; males and females; mean±SD NR; range 43-74</td>
<td>AE, RE; various intensities; 8w-48w</td>
<td>1) Depression (not specified)</td>
<td>Critically low</td>
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<tr>
<td>Weber 2020</td>
<td>37</td>
<td>3224</td>
<td>Older adults; males and females; 72.2±7.3</td>
<td>Tai Chi, Qigong, Yoga, Pilates; various intensities; 4w-1y</td>
<td>1) Depression (GDS, GDS-SF, HADS, BDI, BDI-II, CES-D, DASS-21, MHI-18, POMS, POMS-SF, Taiwanese Depression Questionnaire, Warwick-Edinburgh Mental Well-being Scale)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Wu 2019</td>
<td>6</td>
<td>415</td>
<td>COPD; males and females; 66.3±4.6</td>
<td>Qigong; various intensities; 4w-24w</td>
<td>1) Depression (Self-rating scale) 2) Anxiety (Self-rating scale)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Xiang 2017</td>
<td>10</td>
<td>689</td>
<td>Fatigue; males and females; mean±SD NR; range=18-88</td>
<td>Tai Chi; various intensities; 4w-6m</td>
<td>1) Depression (POMS, POMS-SF, IDS-C, CES-D, BDI, BDI-II)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Yi 2021</td>
<td>7</td>
<td>693</td>
<td>Breast cancer; females; 50.4±3.5</td>
<td>Yoga; various intensities; 8w-16w</td>
<td>1) Depression (BDI, POMS, HADS, Self-rating scale, CES-D) 2) Anxiety (POMS, HADS, Self-rating scale)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Zeng 2019</td>
<td>12</td>
<td>915</td>
<td>Cancer; males and females; 62.2±4.3</td>
<td>Qigong; various intensities; 6w-12w</td>
<td>1) Depression (DASS, HADS) 2) Anxiety (DASS, HADS) 3) Stress (BSI, FACT-G)</td>
<td>Critically low</td>
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<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range).</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<tr>
<td>Zeng 2014</td>
<td>13</td>
<td>592</td>
<td>Cancer; males and females; mean±SD and range NR</td>
<td>Tai Chi; various intensities; 6w-24w</td>
<td>1) Depression (BDI, CES-D)</td>
<td>Critically low</td>
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<td>2) Anxiety (BAI)</td>
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<tr>
<td>Zeng 2019</td>
<td>10</td>
<td>838</td>
<td>Cancer; males and females; 52.5±4.1</td>
<td>AE, RE; various intensities; 8w-96w</td>
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<td>803</td>
<td>Older adults with mild cognitive impairment; males and females; 74.8±5.7</td>
<td>Tai Chi; various intensities; 12w-1y</td>
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<td>13</td>
<td>614</td>
<td>End-stage renal disease; males and females; 54.58±11.68</td>
<td>AR, RE, Yoga; various intensities; 8w-1y</td>
<td>1) Depression (BDI, HADS)</td>
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<td>2) Anxiety (HADS)</td>
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<td>570</td>
<td>Lung cancer; males and females; 64.4±2.1</td>
<td>AR, RE, Tai Chi; various intensities; 6w-12w</td>
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<td>2) Anxiety (HADS, STAI, Self-rating scale)</td>
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<td>3) Distress (Positive and Negative Affect Schedule, Subjective Symptom Checklist, The Rotterdam Symptom Checklist)</td>
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Abbreviations: AE: Aerobic exercise; RE: Resistance exercise; NR: Not reported
**Table 3. AMSTAR 2 quality appraisal of reviews.**

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Note: Y=yes; N=no; Partial Y=meets criteria for partial yes; N/A=not applicable as no meta-analysis conducted

Legend: AMSTAR 2 Items: 1) The Participant, Intervention, Comparator and Outcome (PICO) components included in the review research question and inclusion criteria; 2) Explicit statement included that review methods were established prior to conduct and significant deviations justified; 3) Selection of included study designs explained; 4) Comprehensive search strategy used; 5) Study selection performed in duplicate; 6) Data extraction performed in duplicate; 7) List of excluded studies with justification provided; 8) Included studies described in adequate detail; 9) Satisfactory technique used for assessing risk of bias in included studies; 10) Sources of funding for included studies reported; 11) Appropriate methods for statistical combination of results used if meta-analysis performed; 12) Potential impact of risk of bias of individual studies assessed if meta-analysis performed; 13) Risk of bias of individual studies accounted for in discussion of the review results; 14) Any heterogeneity observed in the review
results was explained and discussed; 15) Publication bias investigated and discussed if meta-analysis performed; 16) Authors reported any potential sources of conflict of interest.
eFigure 3. Results of meta-analyses that assessed depression using mean differences.

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<th>Study, year</th>
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<td>BDI Ferreira 2021</td>
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<td>Fong 2012</td>
<td>-4.10 [-6.50,-1.80]</td>
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<td>EPDS Pentland 2021</td>
<td>-4.01 [-7.18,-0.84]</td>
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<td>McGranahan 2021</td>
<td>-1.92 [-2.91,-0.92]</td>
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<td>Self-rating scale Wu 2019</td>
<td>-3.99 [-6.17,-1.82]</td>
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<td>BSI-18 Vashistha 2016</td>
<td>-3.02 [-7.83,1.79]</td>
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<td>CES-D Broderick 2015</td>
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<td>-0.70 [-3.21,1.81]</td>
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<td>Zhang 2019</td>
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<td>-1.80 [-4.14,0.54]</td>
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BDI: Beck Depression Inventory; CES-D: Center for Epidemiological Studies Depression; EPDS: The Edinburgh Postnatal Depression Scale; HADS: Hospital Anxiety and Depression Scale; MADRS: Montgomery-Asberg Depression Rating Scale; POMS: Profile of Mood States.
eTable 4. Overview of results of meta-analyses using mean differences for anxiety and depression.

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<th>Reviews</th>
<th>Studies</th>
<th>Participants</th>
<th>Mean difference</th>
<th>Standardised mean difference (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile of Mood States</td>
<td>1</td>
<td>2</td>
<td>65</td>
<td>-7.68</td>
<td>-0.96 (-1.47, -0.44)</td>
</tr>
<tr>
<td>Beck Depression Inventory</td>
<td>2</td>
<td>7</td>
<td>&gt;134</td>
<td>-6.24</td>
<td>-0.69 (-1.04, -0.34)</td>
</tr>
<tr>
<td>The Edinburgh Postnatal Depression Scale</td>
<td>2</td>
<td>19</td>
<td>1110</td>
<td>-3.49</td>
<td>-0.74 (-0.86, -0.62)</td>
</tr>
<tr>
<td>Self-rating scale</td>
<td>1</td>
<td>6</td>
<td>415</td>
<td>-3.99</td>
<td>-0.79 (-0.99, -0.59)</td>
</tr>
<tr>
<td>Brief Symptom Inventory 18</td>
<td>1</td>
<td>2</td>
<td>92</td>
<td>-3.02</td>
<td></td>
</tr>
<tr>
<td>Center for Epidemiological Studies Depression</td>
<td>4</td>
<td>6</td>
<td>847</td>
<td>-1.25</td>
<td>-0.72 (-0.85, -0.58)</td>
</tr>
<tr>
<td>Montgomery-Asberg Depression Rating Scale</td>
<td>1</td>
<td>1</td>
<td>117</td>
<td>-1.80</td>
<td>-0.33 (-0.74, -0.07)</td>
</tr>
<tr>
<td>Hospital Anxiety and Depression Scale</td>
<td>8</td>
<td>15</td>
<td>622</td>
<td>-1.41</td>
<td>-0.18 (-0.33, -0.02)</td>
</tr>
</tbody>
</table>

<p>| Anxiety (Instrument)            |         |        |              |                |                                   |
| The State-Trait Anxiety Inventory | 3       | 4       | 262          | -6.01          | -0.51 (-0.76, -0.27)              |
| Brief Symptom Inventory-18      | 1       | 2       | 92           | -5.45          | -0.49 (-0.91, -0.08)              |
| Self-rating scale               | 1       | 6       | 415          | -4.57          | -0.41 (-0.61, -0.22)              |
| Hospital Anxiety and            | 10      | 22      | 3360         | -1.13          | -0.21 (-0.27, -0.14)              |</p>
<table>
<thead>
<tr>
<th>Depression Scale</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
**eFigure 5.** Results of meta-analyses that assessed anxiety using mean differences.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>MD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAI</td>
<td></td>
</tr>
<tr>
<td>Lawrence 2017</td>
<td>-8.40 [-16.74, -0.06]</td>
</tr>
<tr>
<td>Furmanlak 2016</td>
<td>-3.61 [-7.24, 0.03]</td>
</tr>
<tr>
<td>Felbel 2014</td>
<td>0.30 [-5.01, 5.61]</td>
</tr>
<tr>
<td>BSI-18</td>
<td></td>
</tr>
<tr>
<td>Vashistha 2016</td>
<td>-5.45 [-16.17, 5.28]</td>
</tr>
<tr>
<td>Self-rating scale</td>
<td></td>
</tr>
<tr>
<td>Wu 2019</td>
<td>-4.57 [-5.67, -3.46]</td>
</tr>
<tr>
<td>HADS</td>
<td></td>
</tr>
<tr>
<td>Pavey 2011</td>
<td>-4.12 [-11.52, 3.28]</td>
</tr>
<tr>
<td>Zhou 2021</td>
<td>-1.39 [-2.60, 0.18]</td>
</tr>
<tr>
<td>Zeng 2019A</td>
<td>-1.26 [-3.73, 1.20]</td>
</tr>
<tr>
<td>Zeng 2019B</td>
<td>-1.25 [-2.65, 0.15]</td>
</tr>
<tr>
<td>Peddle-McIntyre6 2019</td>
<td>-1.21 [-5.88, 3.45]</td>
</tr>
<tr>
<td>Van Haren 2013</td>
<td>-1.05 [-3.67, 1.57]</td>
</tr>
<tr>
<td>Guo 2020</td>
<td>-1.04 [-1.58, -0.51]</td>
</tr>
<tr>
<td>Fong 2012</td>
<td>-0.70 [-3.40, 2.10]</td>
</tr>
<tr>
<td>McGettigan 2020</td>
<td>1.79 [0.37, 3.94]</td>
</tr>
<tr>
<td>Zeng 2014</td>
<td>1.97 [-3.36, 7.31]</td>
</tr>
</tbody>
</table>

-20 -15 -10 -5 0 5 10 15

Favours physical activity  Favours control

BSI-18: Brief Symptom Inventory-18; HADS: Hospital Anxiety and Depression Scale; STAI: The State-Trait Anxiety Inventory.
eFigure 6. Results of subgroup meta-analyses for depression based on physical activity mode.
Figure 7. Results of subgroup meta-analyses for anxiety based on physical activity mode.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>SMD (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brath 2015</td>
<td>-0.21 (-0.09, 0.51)</td>
</tr>
<tr>
<td>Dance</td>
<td></td>
</tr>
<tr>
<td>Duan 2020</td>
<td>-0.17 (-0.31, 0.66)</td>
</tr>
<tr>
<td>Qigong</td>
<td>-0.52 (-0.85, 0.19)</td>
</tr>
<tr>
<td>Yoga</td>
<td>-0.06 (-0.61, 0.49)</td>
</tr>
<tr>
<td>Dance</td>
<td></td>
</tr>
<tr>
<td>Guocone 2020</td>
<td>-0.11 (-0.50, 0.19)</td>
</tr>
<tr>
<td>Mixed-mode</td>
<td></td>
</tr>
<tr>
<td>Kelley 2015</td>
<td>-0.63 (-0.86, -0.43)</td>
</tr>
<tr>
<td>Mixed-mode</td>
<td></td>
</tr>
<tr>
<td>U 2019</td>
<td>-1.02 (-1.31, -0.64)</td>
</tr>
<tr>
<td>Tai chi</td>
<td>-0.77 (-0.96, -0.59)</td>
</tr>
<tr>
<td>Qigong</td>
<td>-0.62 (-0.82, -0.42)</td>
</tr>
<tr>
<td>Yoga</td>
<td>-0.82 (0.03, 0.39)</td>
</tr>
<tr>
<td>Mixed-mode</td>
<td></td>
</tr>
<tr>
<td>Pearall 2014</td>
<td>-0.26 (-0.91, 0.39)</td>
</tr>
<tr>
<td>Aerobic</td>
<td></td>
</tr>
<tr>
<td>Ramirez-seller 2021</td>
<td>-0.25 (-0.55, 0.02)</td>
</tr>
<tr>
<td>Aerobic</td>
<td></td>
</tr>
<tr>
<td>Mixed-mode</td>
<td>-0.35 (-0.64, 0.27)</td>
</tr>
<tr>
<td>Rames-Sanchez 2021</td>
<td>-0.66 (-1.96, 0.26)</td>
</tr>
<tr>
<td>Aerobic</td>
<td></td>
</tr>
<tr>
<td>Resistance</td>
<td>-0.37 (-0.80, 0.06)</td>
</tr>
<tr>
<td>Mixed-mode</td>
<td>-0.12 (-0.34, 0.08)</td>
</tr>
<tr>
<td>Sathw 2021</td>
<td>-0.99 (-1.92, -0.05)</td>
</tr>
<tr>
<td>Dance</td>
<td></td>
</tr>
<tr>
<td>Singh 2018</td>
<td>-0.37 (-0.65, -0.09)</td>
</tr>
<tr>
<td>Aerobic</td>
<td></td>
</tr>
<tr>
<td>Resistance</td>
<td>-0.08 (-0.44, 0.30)</td>
</tr>
<tr>
<td>Mixed-mode</td>
<td>-1.36 (-1.62, -1.10)</td>
</tr>
<tr>
<td>Other</td>
<td>-0.83 (-1.06, -0.61)</td>
</tr>
<tr>
<td>Singh 2020</td>
<td>-0.17 (-0.42, 0.09)</td>
</tr>
<tr>
<td>Aerobic</td>
<td></td>
</tr>
<tr>
<td>Mixed-mode</td>
<td>-0.34 (-0.63, -0.05)</td>
</tr>
<tr>
<td>Stable 2017</td>
<td>-0.58 (-1.00, -0.16)</td>
</tr>
<tr>
<td>Aerobic</td>
<td></td>
</tr>
<tr>
<td>Wang 2014</td>
<td>-0.29 (-0.47, -0.11)</td>
</tr>
<tr>
<td>Aerobic</td>
<td></td>
</tr>
<tr>
<td>Mind-body</td>
<td>-0.33 (-0.57, -0.09)</td>
</tr>
<tr>
<td>Zhao 2019</td>
<td>-0.78 (-1.17, -0.38)</td>
</tr>
<tr>
<td>Mixed-mode</td>
<td></td>
</tr>
<tr>
<td>Zuo 2016</td>
<td>-0.42 (-0.57, -0.26)</td>
</tr>
<tr>
<td>Yoga</td>
<td></td>
</tr>
</tbody>
</table>

Favour physical activity  Favour control
Figure 8. Results of subgroup meta-analyses for depression based on physical activity intensity.

<table>
<thead>
<tr>
<th>Study year</th>
<th>Intensity</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beilin 2021</td>
<td>Low</td>
<td>-0.22 [-0.56, 0.12]</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>-0.39 [-0.53, -0.25]</td>
</tr>
<tr>
<td>Eng 2014</td>
<td>High</td>
<td>-0.24 [-0.46, -0.02]</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>-0.08 [-0.23, 0.07]</td>
</tr>
<tr>
<td>Ramirez-Velez 2021</td>
<td>Moderate</td>
<td>-0.28 [-0.66, 0.10]</td>
</tr>
<tr>
<td></td>
<td>Moderate-to-vigorous</td>
<td>-0.24 [-0.44, -0.04]</td>
</tr>
<tr>
<td>Schuch 2016</td>
<td>Moderate</td>
<td>-0.73 [0.08, -1.38]</td>
</tr>
<tr>
<td></td>
<td>Vigorous</td>
<td>-1.15 [0.50, -2.80]</td>
</tr>
<tr>
<td>Schuch 2016</td>
<td>Light-to-moderate</td>
<td>-0.59 [-1.19, 0.02]</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>-1.33 [-2.13, -0.53]</td>
</tr>
<tr>
<td></td>
<td>Vigorous</td>
<td>-1.34 [-2.29, -0.44]</td>
</tr>
</tbody>
</table>

Favours physical activity | 0 | Favours control

-3 | -2.5 | -2 | -1.5 | -1 | -0.5 | 0 | 0.5 | 1 | 1.5
Figure 9: Results of subgroup meta-analyses for anxiety based on physical activity intensity.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>SMD (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramirez-valle 2021</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>-0.47 [-0.72, -0.22]</td>
</tr>
<tr>
<td>Moderate-to-vigorous</td>
<td>-0.02 [-0.25, 0.21]</td>
</tr>
<tr>
<td>Ramon-Sanchez 2021</td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td>-0.26 [-0.69, 0.16]</td>
</tr>
<tr>
<td>Moderate-to-vigorous</td>
<td>-0.51 [-0.95, -0.07]</td>
</tr>
<tr>
<td>High</td>
<td>-0.44 [-0.78, -0.10]</td>
</tr>
</tbody>
</table>

Favours physical activity  | Favours control |
Figure 10: Results of subgroup meta-analyses for depression based on intervention duration.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>≤12 weeks</th>
<th>&gt;12 weeks</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellen 2021</td>
<td>-0.68 [-0.74, -0.62]</td>
<td>-0.23 [-0.42, 0.03]</td>
<td></td>
</tr>
<tr>
<td>Cantor 2019</td>
<td>-1.72 [-3.06, -0.39]</td>
<td>-0.52 [-0.84, -0.20]</td>
<td></td>
</tr>
<tr>
<td>Ch 2013</td>
<td>-0.37 [-0.74, 0.02]</td>
<td>-0.27 [-0.52, -0.02]</td>
<td></td>
</tr>
<tr>
<td>Knopf 2017</td>
<td>-0.92 [-1.09, -0.74]</td>
<td>-0.69 [-0.91, -0.47]</td>
<td></td>
</tr>
<tr>
<td>Lasker 2001</td>
<td>-1.30 [-1.80, -0.90]</td>
<td>-0.90 [-1.32, -0.50]</td>
<td></td>
</tr>
<tr>
<td>LI 2019</td>
<td>-1.80 [-2.30, -1.30]</td>
<td>-1.30 [-1.80, -0.90]</td>
<td></td>
</tr>
<tr>
<td>Milbra 2012</td>
<td>-0.90 [-1.32, -0.50]</td>
<td>-0.60 [-0.90, -0.30]</td>
<td></td>
</tr>
<tr>
<td>Panuza 2017</td>
<td>-1.96 [-2.46, -1.47]</td>
<td>-1.69 [-2.66, -0.73]</td>
<td></td>
</tr>
<tr>
<td>Singh 2008</td>
<td>-0.86 [-1.09, -0.65]</td>
<td>-0.64 [-0.90, -0.40]</td>
<td></td>
</tr>
<tr>
<td>Singh 2020</td>
<td>-0.67 [-0.82, -0.51]</td>
<td>-0.53 [-0.70, -0.36]</td>
<td></td>
</tr>
<tr>
<td>Tu 2014</td>
<td>-0.56 [-0.73, -0.27]</td>
<td>-0.37 [-0.53, -0.16]</td>
<td></td>
</tr>
</tbody>
</table>

Favours physical activity

Favours control
Figure 11: Results of subgroup meta-analyses for anxiety based on intervention duration.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li 2019</td>
<td>-1.39 [-1.88, -0.90]</td>
</tr>
<tr>
<td>8-12 weeks</td>
<td>-0.82 [-1.06, -0.59]</td>
</tr>
<tr>
<td>24 weeks</td>
<td>-0.71 [-0.91, -0.51]</td>
</tr>
<tr>
<td>Mishra 2012</td>
<td>-0.26 [-0.44, -0.07]</td>
</tr>
<tr>
<td>8-12 weeks</td>
<td>0.06 [-0.23, 0.35]</td>
</tr>
<tr>
<td>12 weeks to 6 months</td>
<td>-0.15 [-0.61, 0.30]</td>
</tr>
<tr>
<td>Singh 2018</td>
<td>-0.83 [-1.01, -0.62]</td>
</tr>
<tr>
<td>&lt;12 weeks</td>
<td>-0.73 [-0.91, -0.55]</td>
</tr>
<tr>
<td>&gt;12 weeks</td>
<td>-0.28 [-0.58, 0.03]</td>
</tr>
<tr>
<td>Singh 2020</td>
<td>-0.22 [-0.42, -0.01]</td>
</tr>
</tbody>
</table>
Figure 12: Results of subgroup meta-analyses for depression based on weekly duration.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>SMD (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berlin 2021</td>
<td></td>
</tr>
<tr>
<td>Up to 150 minutes/week</td>
<td>-0.34 [-0.51, -0.17]</td>
</tr>
<tr>
<td>&gt;150 minutes/week</td>
<td>-0.44 [-0.66, -0.22]</td>
</tr>
<tr>
<td>Patou 2017</td>
<td></td>
</tr>
<tr>
<td>&lt;155 mins/week</td>
<td>-0.20 [-0.40, 0.01]</td>
</tr>
<tr>
<td>&gt;155 mins/week</td>
<td>-0.82 [-1.54, -0.10]</td>
</tr>
<tr>
<td>Ramirez-valez 2021</td>
<td></td>
</tr>
<tr>
<td>&lt;150 mins/week</td>
<td>-0.24 [-0.45, -0.03]</td>
</tr>
<tr>
<td>&gt;150 mins/week</td>
<td>-0.36 [-0.6, 0.03]</td>
</tr>
<tr>
<td>Satku 2021</td>
<td></td>
</tr>
<tr>
<td>&lt;150 mins/week</td>
<td>-0.39 [-0.75, -0.04]</td>
</tr>
<tr>
<td>&gt;150 mins/week</td>
<td>-0.69 [-0.90, -0.48]</td>
</tr>
</tbody>
</table>

-2 -1.5 -1 -0.5 0 0.5 1
Favours physical activity     Favours control
**Figure 13:** Results of subgroup meta-analyses for anxiety based on weekly duration, session duration and session frequency.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>Weekly duration</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramirez-vellez 2021</td>
<td>&lt;150 min/week</td>
<td>-1.23 [2.42, -0.04]</td>
</tr>
<tr>
<td></td>
<td>≥150 min/week</td>
<td>-0.99 [1.02, -0.05]</td>
</tr>
<tr>
<td>El 2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session duration</td>
<td>30 to 60 min</td>
<td>-0.83 [1.04, -0.61]</td>
</tr>
<tr>
<td></td>
<td>60 to 90 min</td>
<td>-0.63 [0.87, -0.40]</td>
</tr>
<tr>
<td></td>
<td>2-5 sessions/week</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4-5 sessions/week</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6-7 sessions/week</td>
<td></td>
</tr>
</tbody>
</table>

-3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1

Favours physical activity

Favours control
Figure 14: Results of subgroup meta-analyses for depression based on session frequency.

<table>
<thead>
<tr>
<th>Study year</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-4 sessions/week</td>
<td>-0.35 [-0.54, -0.16]</td>
</tr>
<tr>
<td>5-7 sessions/week</td>
<td>-0.32 [-0.69, 0.06]</td>
</tr>
<tr>
<td>≥3 sessions/week</td>
<td>-1.29 [-2.24, -0.34]</td>
</tr>
<tr>
<td>≥5 sessions/week</td>
<td>-0.59 [-0.89, -0.29]</td>
</tr>
<tr>
<td>≥6-7 sessions/week</td>
<td>-0.85 [-1.34, -0.37]</td>
</tr>
<tr>
<td>≥8 sessions/week</td>
<td>-1.20 [-1.95, -0.46]</td>
</tr>
</tbody>
</table>

Favours physical activity vs. favours control.
Figure 15: Results of subgroup meta-analyses for depression based on session duration.
**eTable 1. Medline search strategy and terms**

<table>
<thead>
<tr>
<th>MEDLINE(R) ALL &lt;1946 to November 12, 2021&gt;</th>
<th>Ovid MEDLINE(R) ALL &lt;1946 to November 19, 2021&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Meta-Analysis as Topic/</td>
<td>34 human/</td>
</tr>
<tr>
<td>2 meta analy$.tw.</td>
<td>35 33 not (33 and 34) 36 or/30-32,35</td>
</tr>
<tr>
<td>3 metaanaly$.tw.</td>
<td>37 9 or 18 or 24 or 29</td>
</tr>
<tr>
<td>4 Meta-Analysis/</td>
<td>38 37 not 36</td>
</tr>
<tr>
<td>5 Systematic Review/ [addition]</td>
<td>39 exp exercise/</td>
</tr>
<tr>
<td>6 Systematic Reviews as Topic/ [addition]</td>
<td>40 exp exercise therapy/</td>
</tr>
<tr>
<td>7 (systematic adj (review$1 or overview$1)).tw.</td>
<td>41 exp sports/</td>
</tr>
<tr>
<td>8 exp Review Literature as Topic/</td>
<td>42 Physical Fitness/</td>
</tr>
<tr>
<td>9 or/1-8</td>
<td>43 (physical* adj5 (fit* or train* or activ* or endur* or exer*)).ti,ab.</td>
</tr>
<tr>
<td>10 cochrane.ab.</td>
<td>44 (exercis* adj5 (train* or physical* or activ*)).ti,ab.</td>
</tr>
<tr>
<td>11 embase.ab.</td>
<td>45 sport*.ti,ab.</td>
</tr>
<tr>
<td>12 (psychlit or psyclit).ab.</td>
<td>46 walk*.ti,ab.</td>
</tr>
<tr>
<td>13 (psychinfo or psycinfo).ab.</td>
<td>47 swim*.ti,ab.</td>
</tr>
<tr>
<td>14 (cinahl or cinhal).ab.</td>
<td>48 pilates.ti,ab.</td>
</tr>
<tr>
<td>15 science citation index.ab.</td>
<td>49 step*.ti,ab.</td>
</tr>
<tr>
<td>16 bids.ab.</td>
<td>50 HIIT.ti,ab.</td>
</tr>
<tr>
<td>17 cancerlit.ab.</td>
<td>51 (tai ji or tai chi or tai-ji or tai-chi).ti,ab.</td>
</tr>
<tr>
<td>18 or/10-17</td>
<td>52 (resistance adj3 train*).ti,ab.</td>
</tr>
<tr>
<td>19 reference list$.ab.</td>
<td>53 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46</td>
</tr>
<tr>
<td>20 bibliography$.ab.</td>
<td>or 47 or 48 or 49 or 50 or 51 or 52</td>
</tr>
<tr>
<td>21 hand-search$.ab.</td>
<td>54 38 and 53</td>
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<tr>
<td>22 relevant journals.ab.</td>
<td>55 depress*.ti,ab.</td>
</tr>
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<td>23 manual search$.ab.</td>
<td>56 anxiety.ti,ab.</td>
</tr>
<tr>
<td>24 or/19-23</td>
<td>57 distress.ti,ab.</td>
</tr>
<tr>
<td>25 selection criteria.ab.</td>
<td>58 55 or 56 or 57</td>
</tr>
<tr>
<td>26 data extraction.ab.</td>
<td>59 54 and 58</td>
</tr>
<tr>
<td>27 25 or 26</td>
<td>60 food.ti,ab.</td>
</tr>
<tr>
<td>28 Review/</td>
<td>61 diet*.ti,ab.</td>
</tr>
<tr>
<td>29 27 and 28</td>
<td>62 nutriti*.ti,ab.</td>
</tr>
<tr>
<td>30 Comment/</td>
<td>63 59 not (60 or 61 or 62)</td>
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<tr>
<td>31 Letter/</td>
<td></td>
</tr>
<tr>
<td>32 Editorial/</td>
<td></td>
</tr>
<tr>
<td>33 animal/</td>
<td></td>
</tr>
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</table>
eFigure 1. PRISMA flow diagram.

Identification of studies via databases and registers

Records identified from: Databases (n=1280) Registers (n=0)

Records removed before screening: Duplicate records removed (n = 14)

Records screened (n=1266)

Records excluded (n=837)

Reports sought for retrieval (n=429)

Reports not retrieved (n=0)

Reports assessed for eligibility (n=429)

Reports excluded (n=332):
- Includes non-RCTs (n=127)
- Includes non-PA/non-exercise interventions (e.g., diet) (n=53)
- No meta-analysis of relevant outcomes (n=35)
- Not a SR/MA (n=29)
- Inappropriate comparison conditions (n=23)
- Not a peer-reviewed journal article (n=23)
- No measure of relevant outcomes (n=14)
- Non-adult populations (n=14)
- Non-English language (n=11)
- Includes non-PA/non-exercise (n=4)
- Includes single bout or acute effects of PA/exercise (n=3)
- >25% of the studies have inappropriate comparison groups (n=2)

Studies included in review (n=97)
eFigure 2. Funnel plot showing the relationship between systematic review-level standardised mean differences and the number of studies included in each meta-analysis for depression and anxiety.
eTable 2. Overview of all included studies.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Studies (n=)</th>
<th>Total sample (n=)</th>
<th>Population or condition; gender; age mean±SD or range (years)</th>
<th>Main interventions; intensity; duration (range)</th>
<th>Relevant outcomes (instruments)</th>
<th>AMSTAR category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adamson 2015</td>
<td>26</td>
<td>1324</td>
<td>Neurological disorders; males and females; mean±SD and range NR</td>
<td>AE, RE, Yoga, Tai Chi, Qigong, gymnastics; various intensities; 4w-52w</td>
<td>1) Depression (BDI, BDI-II, CES-D, CESD-10, CSDD, GDS, HADS, IDS-SR, Levine-Pilowsky depression questionnaire, MADRS, MDI, POMS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Aylett 2018</td>
<td>15</td>
<td>675</td>
<td>Anxiety; males and females; mean±SD and range NR</td>
<td>AE, RE; various intensities; 2w-10w</td>
<td>1) Anxiety (PSWQ, Liebowitz Social scale, Anxiety Sensitivity Index, BAI, STAI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Barreto 2015</td>
<td>20</td>
<td>1627</td>
<td>Dementia; males and females; mean±SD and range NR</td>
<td>AE, RE, Tai Chi, dance; various intensities; 6w-1y</td>
<td>1) Depression (GDS-15, GDS-30, MADRS, GSDD)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Bellón 2021</td>
<td>14</td>
<td>1737</td>
<td>Adults without depression; males and females; 44.7±18.6</td>
<td>AE, RE, Yoga; various intensities; 4w-2y</td>
<td>1) Depression (HADS, PHQ-9, BDI, SCID-I, EPDS, POMS, CES-D, BDI-FS, GDS, BDI-II)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Bergenthal 2014</td>
<td>9</td>
<td>818</td>
<td>Haematological cancer; males and females; 50.7±2.4</td>
<td>AE, RE; various intensities; 10d-36w</td>
<td>1) Depression (not specified) 2) Anxiety (not specified)</td>
<td>High</td>
</tr>
<tr>
<td>Bradt 2015</td>
<td>5</td>
<td>207</td>
<td>Breast cancer; females; 55.4±4.8</td>
<td>Dance; various intensities; 3w-12w</td>
<td>1) Depression (POMS, HADS) 2) Anxiety (HADS, Symptom Checklist 90-Revised)</td>
<td>High</td>
</tr>
<tr>
<td>Bridle 2012</td>
<td>9</td>
<td>667</td>
<td>Older adults with depression; males and females; 75.7±6.8</td>
<td>AE, RE, Tai Chi, Qigong; various intensities; 12w-1y</td>
<td>1) Depression (PHQ-9, GDS, HSCL-20, CES-D, HRSD, BDI, BDI-II)</td>
<td>Low</td>
</tr>
<tr>
<td>Brinsley 2020</td>
<td>19</td>
<td>1080</td>
<td>Mental disorders; males and females; 38.5±9.4</td>
<td>Yoga; various intensities; 5w-16w</td>
<td>1) Depression (PANSS, HDRS, CES-D, HAD-C, FBGL, DASS-21, CDS, BDI, CAPS, HAM-D-21, QIDS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Broderick 2015</td>
<td>8</td>
<td>457</td>
<td>Schizophrenia; males and females; mean±SD and range NR</td>
<td>Yoga; various intensities; 5w-16w</td>
<td>1) Depression (Calgary Depression Scale)</td>
<td>Low</td>
</tr>
<tr>
<td>Brown 2012</td>
<td>40</td>
<td>2929</td>
<td>Cancer; males and females; 51.3±6.5</td>
<td>AE, RE, Yoga; various intensities; 3w-1y</td>
<td>1) CES-D, Center for Epidemiologic Studies Depression scale; POMS, Profile of Mood States; BDI, Beck Depression Inventory; HADS, Hospital Anxiety and Depression Scale; Symptom Assessment Scale.</td>
<td>Critically low</td>
</tr>
<tr>
<td>Carter 2019</td>
<td>18</td>
<td>1428</td>
<td>Postnatal women; females; 29.3±2.9</td>
<td>AE, RE; various intensities; 6w-14m</td>
<td>1) Depression (DASS, EPDS, GHQ12, HDRS, IDAS, PHQ, SCID, SF-36, HAM-D, SCID-PN diagnosis, SF-36v2, CES-D, PHQ-9, SCID-I)</td>
<td>Low</td>
</tr>
<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range).</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<tr>
<td>Chi 2013</td>
<td>4</td>
<td>253</td>
<td>Older adults with depressive symptoms; males and females; mean±SD NR; age range=52-82</td>
<td>Tai Chi; low-intensity; 12w-24w</td>
<td>1) Depression (DASS-21, CES-D)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Choo 2020</td>
<td>13</td>
<td>869</td>
<td>Chronic diseases; males and females; 67.2±3.5</td>
<td>Tai Chi; low-intensity; 10w-24w</td>
<td>1) Depression (CES-D, Zung depression scale, Depression, Anxiety, and Stress Scales)</td>
<td>Low</td>
</tr>
<tr>
<td>Chung 2017</td>
<td>17</td>
<td>651</td>
<td>End Stage Renal Disease; males and females; mean±SD and range NR</td>
<td>AE, RE; various intensities; 8w-48w</td>
<td>1) Depression (Zung depression scale, BDI, SF-36)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Cooney 2013</td>
<td>59</td>
<td>2326</td>
<td>Depression; males and females; 52.7±19.3</td>
<td>AE, RE; various intensities; 10d-16w</td>
<td>1) Depression (Hamilton Rating Scale for Depression, BDI, BDI-II, Lubin’s Depression Adjective List, Zung Depression Scale, MADRS, HAM-D, Global Assessment Scale, CES-D, POMS, Cornell Scale for Depression in Dementia, GDS)</td>
<td>High</td>
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<tr>
<td>Coventry 2007</td>
<td>6</td>
<td>545</td>
<td>COPD; males and females; 65.3±2.9</td>
<td>AE, RE; various intensities; 5w-1y</td>
<td>1) Depression (HADS, Lorr-McNair Mood Questionnaire, CES-D, SCL-90-R)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Craft 2012</td>
<td>15</td>
<td>1371</td>
<td>Cancer; males and females; 55.1±7.8</td>
<td>AE, RE; various intensities; 6w-6m</td>
<td>1) Depression (CES-D Short Form, CES-D, BDI-II, HADS)</td>
<td>Critically low</td>
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<tr>
<td>Dalgas 2015</td>
<td>15</td>
<td>591</td>
<td>Multiple sclerosis; males and females; 46.7±6.3</td>
<td>AE, RE, water aerobics, yoga, sports climbing; various intensities; 3w-26w</td>
<td>1) Depression (BDI-I, BDI-II HADS-D, MDI, CES-D, IDS-SR30, POMS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>deAlmeida 2020</td>
<td>16</td>
<td>1129</td>
<td>Dementia; males and females; 77.3±7.3</td>
<td>AE, RE; various intensities; 6w-2y</td>
<td>1) Depression (Cornell Scale for Depression in Dementia, NPI Depression, GDS – Short Form)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Duan 2020</td>
<td>15</td>
<td>1461</td>
<td>Cancer; males and females; 54.6±6.6</td>
<td>Yoga, Qigong, Tai Chi, Dance; various intensities; 3w-24w</td>
<td>1) Depression (HADS, BDI, CES-D, PHQ-9)</td>
<td>Critically low</td>
</tr>
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<td>Eng 2014</td>
<td>13</td>
<td>1022</td>
<td>Stroke; males and females; mean±SD NR; age range=21-91</td>
<td>AE, RE; various intensities; 4-12w</td>
<td>1) Depression (HADS, GDS, BDI, CES-D)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Ensari 2014</td>
<td>13</td>
<td>477</td>
<td>Multiple sclerosis; males and females; 45.1±5.8</td>
<td>AE, RE, water aerobics, yoga; various intensities; 4-26w</td>
<td>1) Depression (BFI, IFD, MDI, BDI-II, HADS, CES-D, POMS, POMS-SF)</td>
<td>Critically low</td>
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<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range).</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<tr>
<td>Felbel 2014</td>
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<td>39</td>
<td>Haematological cancer; males and females; 51</td>
<td>Yoga; low intensity; 7w</td>
<td>1) Depression (CES-D)</td>
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<td></td>
<td>2) Anxiety (STAI)</td>
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<td>3) Distress (Impact of Events Scale)</td>
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<td>Ferreira 2021</td>
<td>8</td>
<td>376</td>
<td>Kidney disease; males and females; 51.7±8.6</td>
<td>AE, RE, Pilates, intradialytic exercise; various intensities; 4w-48w</td>
<td>1) Depression (HADS, DASS, BDI, General Health Dimensions - depression subscale)</td>
<td>Critically low</td>
</tr>
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<td>2) Anxiety (HADS, DASS)</td>
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<tr>
<td>Fong 2012</td>
<td>34</td>
<td>4113</td>
<td>Cancer; males and females; 55.7±5.8</td>
<td>AE, RE, Yoga; various intensities; 3w-60w</td>
<td>1) Depression (HADS, BDI)</td>
<td>Critically low</td>
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<td>2) Anxiety (HADS)</td>
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<tr>
<td>Forbes 2008</td>
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<td>280</td>
<td>Dementia; males and females; mean±SD and range NR</td>
<td>AE, RE; various intensities; 2w-1y</td>
<td>1) Depression (MADRS)</td>
<td>Low</td>
</tr>
<tr>
<td>Furmaniak 2016</td>
<td>32</td>
<td>2626</td>
<td>Breast cancer; females; mean±SD and range NR</td>
<td>AE, RE; various intensities; 6w-1y</td>
<td>1) Depression (BDI, CES-D, HADS)</td>
<td>High</td>
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<td>2) Anxiety (STAI, HADS)</td>
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<tr>
<td>Gascoyne 2020</td>
<td>4</td>
<td>133</td>
<td>Multiple sclerosis; males and females; 43.9±7.6</td>
<td>AE, RE; various intensities; 8w-26w</td>
<td>1) Anxiety (POMS, HADS, STAI, BAI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Gong 2015</td>
<td>6</td>
<td>375</td>
<td>Pregnant women; females only; mean±SD NR; range = 18-40</td>
<td>Yoga; various intensities;12w-16w</td>
<td>1) Depression (CES-D, HADS, EPDS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Gordon 2018</td>
<td>33</td>
<td>1877</td>
<td>Adults with or without chronic conditions; males and females; 52±18</td>
<td>RE; various intensities; 6w-1y</td>
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<tr>
<td>Gouw 2019</td>
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<td>1340</td>
<td>Older adults with chronic disease; males and females; 70.4±6.2</td>
<td>Qigong; low intensity; 8w-26w</td>
<td>1) Depression (GDS, HADS, HRSR, Self-rating scale)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Guo 2020</td>
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<td>1096</td>
<td>COPD; males and females; 67.4±4.9</td>
<td>Tai Chi; various intensities; 2w-1y</td>
<td>1) Depression (HADS, Self-rating scale)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Hall 2021</td>
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<td>1456</td>
<td>Knee osteoarthritis; males and females; 65.9±4.6</td>
<td>AE, RE, Yoga, Tai chi, Qigong; various intensities; 6w-1y</td>
<td>1) Depression (HADS, CES-D)</td>
<td>Critically low</td>
</tr>
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<td>2) Anxiety (HADS)</td>
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<tr>
<td>Heinzel 2015</td>
<td>18</td>
<td>1063</td>
<td>Older adults; males and females; 71.9±6.0</td>
<td>AE, RE, Tai chi, Qigong; various intensities; 6w-26w</td>
<td>1) Depression (HADS, HDG, HAM-D, PHQ-9, BDI, DSM-IV diagnostic criteria)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Heissel 2019</td>
<td>10</td>
<td>479</td>
<td>HIV; males and females; mean±SD and range NR</td>
<td>AE, RE, Yoga; various intensities; 4w-12w</td>
<td>1) Depression (BDI, GHQ-28, POMS, HADS)</td>
<td>High</td>
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<tr>
<td></td>
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<td></td>
<td></td>
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<td>2) Anxiety (GHQ-28, POMS, HADS, STAI)</td>
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<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range).</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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</tr>
<tr>
<td>Herring 2017</td>
<td>14</td>
<td>624</td>
<td>Multiple Sclerosis; males and females; 44±6.6</td>
<td>AE, RE, Yoga; various intensities; 3w-26w</td>
<td>1) Depression (BDI, CES-D, HADS, IDS-SR, POMS, MDI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Josefssson 2014</td>
<td>15</td>
<td>880</td>
<td>Depression; males and females; 46.3±13</td>
<td>AE, RE; various intensities; 4w-16w</td>
<td>1) Depression (HRSD, BDI, MARDS, PHQ-9, MMPI)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Kelley 2018</td>
<td>14</td>
<td>926</td>
<td>Arthritis and rheumatic diseases; males and females; 54.5±8.9</td>
<td>AE; RE; various intensities; 8w-32w</td>
<td>1) Depression (AIMS, BDI, CES-D, DASS-21, FIQ, HADS, MHI, VAS)</td>
<td>High</td>
</tr>
<tr>
<td>Kelley 2015</td>
<td>29</td>
<td>2449</td>
<td>Depression; males and females; 52.3±9.7</td>
<td>AE, RE, Tai chi, Qigong; various intensities; 4w-32w</td>
<td>1) Depression (BDI, CES-D, DASS-21, MIH, FIQ, AIMS, POMS, HADS, VAS)</td>
<td>High</td>
</tr>
<tr>
<td>Krogh 2017</td>
<td>35</td>
<td>2498</td>
<td>Depression; males and females; 44±12.8</td>
<td>AE, RE; various intensities; 2w-32w</td>
<td>1) Depression (HAM-D17, SCL-D, BDI, MADRS, PHQ-9)</td>
<td>Low</td>
</tr>
<tr>
<td>Kvam 2016</td>
<td>23</td>
<td>977</td>
<td>Depression; males and females; 36.9±14.4</td>
<td>AE, RE; various intensities; 1w-8m</td>
<td>1) Depression (HAM-D-17, MDD, BDI, BDI-II, SCL-90)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Lawlor 2001</td>
<td>14</td>
<td>479</td>
<td>Depression; males and females; 44.7±17</td>
<td>AE, RE; various intensities; 4w-12w</td>
<td>1) Depression (BDI, Depression symptom checklist)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Lawrence 2017</td>
<td>2</td>
<td>72</td>
<td>Stroke; males and females; 59.5±4.6</td>
<td>Yoga; various intensities; 8w-10w</td>
<td>1) Depression (GDS15)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Lee 2021</td>
<td>22</td>
<td>1025</td>
<td>Depression; males and females; 48.5±12.6</td>
<td>AE, RE; various intensities; 10d-24w</td>
<td>1) Depression (BDI-II, HAM-D, BDI, MADRS, MARD-S, BRMS, GDS)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Lee 2020</td>
<td>29</td>
<td>2989</td>
<td>Breast cancer; females; 50±7.7</td>
<td>AE, RE; Yoga; various intensities; 4w-26w</td>
<td>1) Depression (HADS, CES-D)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Leng 2018</td>
<td>21</td>
<td>2589</td>
<td>Cognitive impairment; males and females; 76.3±5.9</td>
<td>AE, RE; Tai Chi, Yoga; various intensities; 6w-1y</td>
<td>1) Depression (CSDD, GDS, Depression Rating Scale, BDI, HAMD)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Liu 2019</td>
<td>6</td>
<td>429</td>
<td>Lymphoma; males and females; 53.6±6.4</td>
<td>AE, Yoga, Qigong; various intensities; 3w-36w</td>
<td>1) Depression (CES-D)</td>
<td>Critically low</td>
</tr>
<tr>
<td>Li 2019</td>
<td>13</td>
<td>906</td>
<td>COPD; males and females; 63.9±6.9</td>
<td>Yoga, Qigong, Tai chi, various intensities; 8w-48w</td>
<td>1) Depression (CES-D, SSAI, HADS, BDI, Self-rating scale, HAM)</td>
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<tr>
<td>Reference</td>
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<td>Main interventions; intensity; duration (range)</td>
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<tr>
<td>Li 2019</td>
<td>20</td>
<td>2051</td>
<td>Dementia; males and females; 80.9±5.1</td>
<td>AE, RE, dance; various intensities; 6w-18m</td>
<td>1) Depression (HAMD-17, GDS, CSDD, MADRS)</td>
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<tr>
<td>Lund 2020</td>
<td>8</td>
<td>552</td>
<td>Colorectal cancer; males and females; 58±4.6</td>
<td>AE, RE; various intensities; 6w-24w</td>
<td>1) Depression (HADS, BDI)</td>
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<td>Lyu 2021</td>
<td>11</td>
<td>732</td>
<td>Stroke patients with mental or sleep disorders; males and females; 62.2±6.6</td>
<td>Tai Chi; low intensity; 6w-24w</td>
<td>1) Depression (CES-D, HAM-D, BDI)</td>
<td>Critically low</td>
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<tr>
<td>McCurdy 2017</td>
<td>16</td>
<td>1327</td>
<td>Postpartum women, females; 29.6±2.8</td>
<td>AE, RE, Yoga; various intensities; 6w-1y</td>
<td>1) Depression (EPDS, CES-D, HAMD)</td>
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<tr>
<td>McGettigan 2020</td>
<td>16</td>
<td>992</td>
<td>Colorectal cancer; males and females; 59.5±4.6</td>
<td>AE, RE; various intensities; 6w-1y</td>
<td>1) Depression (HADS, CES-D)</td>
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<td>McGranahan 2021</td>
<td>4</td>
<td>149</td>
<td>PTSD; males and females; 44.7±16.3</td>
<td>AE, RE; various intensities; 3w-12w</td>
<td>1) Depression (CES-D, DASS, PHD)</td>
<td>Critically low</td>
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<td></td>
<td></td>
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<td>2) Anxiety (STAI, DASS)</td>
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<td>Miller 2020</td>
<td>69</td>
<td>5379</td>
<td>Older adults; males and females; 73.4±5.6</td>
<td>AE, RE, Yoga, Tai Chi, Qigong; various intensities; 4w-15m</td>
<td>1) Depression (BDI, CESD-20, POMS-D, GDS-15, GDS-30, BDI-II, MADRS, GADS-D, CSDD, TDQ, HADS-D, HRSD, DASS-D, IDS-C, GDS-5, POMS-SF-D, CESD-10, PROMIS-EDD SF-8a, CESD-6)</td>
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<tr>
<td>Miller 2020</td>
<td>15</td>
<td>596</td>
<td>Older adults with depression; males and females; 73.9±5.9</td>
<td>AE, RE, Yoga, Tai Chi, Qigong, dance; various intensities; 4w-16w</td>
<td>1) Depression (GDS-15, CESD-20, GDS-30, HRSD, BDI, CSDD)</td>
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<td>Mishra 2012</td>
<td>40</td>
<td>3694</td>
<td>Cancer; males and females; 51.3±5.4</td>
<td>AE, RE, Yoga, Tai Chi, Qigong; various intensities; 3w-1y</td>
<td>1) Depression (CES-D, HADS, BDI, VAS, POMS)</td>
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<tr>
<td>Morres 2019</td>
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<td>455</td>
<td>Depression; males and females; Mean (SD) = 37 (9.4); range = 20.9-49.1</td>
<td>AE; various intensities; 10d-32w</td>
<td>1) Depression (HAMD-17, BDI, CIS, MADRS)</td>
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<tr>
<td>Nebiker 2018</td>
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<td>1452</td>
<td>Depression; males and females; 49.5±16.0</td>
<td>AE, RE, Yoga, Tai Chi; various intensities; 10d-32w</td>
<td>1) Depression (BDI, BDI-II, HRSD, CES-D, GDS-15, GDS, HAMD, MADRS, PHQ-9)</td>
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<td>Reference</td>
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<td>Nixon 2005</td>
<td>10</td>
<td>276</td>
<td>HIV/AIDS; males and females; mean±SD NR; age range=18-58</td>
<td>AE, RE; various intensities; 5w-24w</td>
<td>1) Depression (POMS)</td>
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<td>Park 2014</td>
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<td>3297</td>
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<td>1) Depression (GDS, GDS-15, HADS, Zung Self-rating depression scale, CES-D)</td>
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<td>Patsou 2017</td>
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<td>Breast cancer; females; 52.1±2.9</td>
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<td>1) Depression (HADS, BDI-II, CES-D, POMS)</td>
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<tr>
<td>Pavey 2011</td>
<td>8</td>
<td>5109</td>
<td>Adults; males and females; 59±7</td>
<td>AE; various intensities 8w-52w</td>
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<td>Pearsall 2014</td>
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<td>374</td>
<td>Schizophrenia; males and females; mean±SD NR; range = 27-52</td>
<td>AE; various intensities 10w-24w</td>
<td>1) Depression (BSI, WHOQOL-BREF-TR, BDI, MHI, CGI-Severity)</td>
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<td>Peddle-McIntyre6 2019</td>
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<td>221</td>
<td>Lung cancer; males and female; 60.9±5.3</td>
<td>AE, RE; various intensities 4w-12w</td>
<td>1) Depression (GHQ-12, HADS)</td>
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<td>Pentland 2021</td>
<td>5</td>
<td>242</td>
<td>Postpartum women; females; 30±3.5</td>
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<td>1) Depression (EPDS)</td>
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<td>Ramachandra n 2021</td>
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<td>1) Depression (Patient Health Questionnaire, CES-D, DASS)</td>
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<td>Ramirez-Velez 2021</td>
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<td>6988</td>
<td>Breast cancer; females; 52.3±3.3</td>
<td>AE, RE; various intensities 5w-1y</td>
<td>1) Depression (HADs, FACT-B Depression, BDI, Finnish version of modified BDI, CES-D)</td>
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<td>Ramos-Sanchez 2021</td>
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<td>Anxiety disorder; males and females; 39.2±11.7</td>
<td>AE, RE; various intensities 3w-20w</td>
<td>1) Anxiety (Hamilton Scale for Anxiety, Penn State Worry Questionnaire, Anxiety stress scale, Chinese Mandarin version STAI)</td>
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<td>Older adults; males and females; 73.9±5.2</td>
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<td>1) Depression (GSD, CES-D, GSD-15, BDI, Taiwanese Depression Questionnaire, HSCL-20, DASS, HDRS, Cornell Scale for Depression in Dementia, MADRS)</td>
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</tr>
<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n=)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range)</td>
<td>Relevant outcomes (instruments)</td>
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<td>200</td>
<td>PTSD; males and females; 43.7±6.7</td>
<td>AE, RE, Yoga; various intensities; 6w-12w</td>
<td>1) Depression (PSS-I, PCL-C, CAPS)</td>
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<td>Russ 2021</td>
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<td>456</td>
<td>Dementia; males and females; 85.5±1</td>
<td>RE; various intensities; 12w-7m</td>
<td>1) Depression (GDS, CCSD, MADRS)</td>
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<td>Salihu 2021</td>
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<td>2249</td>
<td>Adults; males and females; 65.3±16</td>
<td>Dance; various intensities; 10d-1y</td>
<td>1) Depression (BDI, GDS, POMS, CESD, HADS, DASS-21) 2) Anxiety (Test Anxiety Inventory, DASS-21, HADS, STAI)</td>
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<tr>
<td>Schuch 2016</td>
<td>8</td>
<td>267</td>
<td>Older adults with depression or depressive symptoms; males and females; 69.5±0.71</td>
<td>AE, RE; various intensities; 6w-16w</td>
<td>1) Depression (HAM-D, GDS-15, BDI, GDS, PHQ-9, CES-D, CSDD)</td>
<td>Critically low</td>
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<tr>
<td>Schuch 2016</td>
<td>25</td>
<td>1487</td>
<td>Depression or depressive symptoms; males and females; 50.9±17.1</td>
<td>AE, RE; various intensities; 4w-32w</td>
<td>1) Depression (HAM-D, BDI, BDI-II, MARSD, GDS-15, CES-D, PHQ-9, DACL, MMPI, CSDD)</td>
<td>Critically low</td>
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<tr>
<td>Schumacher 2021</td>
<td>7</td>
<td>391</td>
<td>Prostate cancer, males; 67.9±1.5</td>
<td>AE, RE; various intensities; 4w-24w</td>
<td>1) Depression (CES-D, BDI)</td>
<td>Critically low</td>
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<tr>
<td>Singh 2018</td>
<td>61</td>
<td>5200</td>
<td>Breast cancer; females; 51±3.6</td>
<td>AE, RE, Yoga; various intensities; 6w-1y</td>
<td>1) Depression (POMs, HADs, CES-D, Greene Climacteric Scale, NDI, Functional Living Index of Cancer 2) Anxiety (POMs, HADs, STAI, FACT-Anemia, Greene Climacteric Scale, SSAS, Social Physique Anxiety Scale, Functional Living Index of Cancer)</td>
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<td>Singh 2020</td>
<td>31</td>
<td>2109</td>
<td>Lung cancer; males and females; 64±3</td>
<td>AE, RE, Yoga; various intensities; 1w-20w</td>
<td>1) Depression (HADs, GHQ) 2) Anxiety (HADs, GHQ)</td>
<td>Critically low</td>
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<td>Stathopoulou 2006</td>
<td>11</td>
<td>513</td>
<td>Depression; males and females; mean±SD and range NR</td>
<td>AE, RE; various intensities; 4w-16w</td>
<td>1) Depression (HRSD, EPSD, BDI, Self-rating scale, Depression - Symptom Checklist 90)</td>
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<tr>
<td>Stubbs 2017</td>
<td>6</td>
<td>262</td>
<td>Anxiety or stress disorder; males and females; 34.7±9.6</td>
<td>AE; various intensities; 6w-12w</td>
<td>1) Anxiety (HAM-A, Penn State Worry Questionnaire, PSWQ, DASS21, PTSD symptom scale, PSSI, PTSD checklist–civilian version)</td>
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</tr>
<tr>
<td>Reference</td>
<td>Studies (n=)</td>
<td>Total sample (n)</td>
<td>Population or condition; gender; age mean±SD or range (years)</td>
<td>Main interventions; intensity; duration (range).</td>
<td>Relevant outcomes (instruments)</td>
<td>AMSTAR category</td>
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<td>Tu 2014</td>
<td>19</td>
<td>3447</td>
<td>Heart failure; males and females; 63.7±7.8</td>
<td>AE, RE, Tai Chi; various intensities; 6w-76w</td>
<td>1) Depression (Depression - Symptom Checklist 90, HADS, BDI, BDI-II, MADRS, Multiple Affect Adjective Checklist, GDS, HAM-D, Cognitive Behavioural Assessment Hospital form, CES-D, Psychological General Well-being Index, Hare-Davis Cardiac Depression Scale, POMS)</td>
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<td>vanHaren 2013</td>
<td>11</td>
<td>734</td>
<td>Cancer; males and females; mean±SD and range NR</td>
<td>RE, AE; various intensities; 4w-24w</td>
<td>1) Depression (POMS, HADS) 2) Anxiety (POMS, HADS) 3) Distress (Self-perception scale of physical and emotional well-being)</td>
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<td>Vashistha 2016</td>
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<td>1057</td>
<td>Prostate cancer; males; 69.2±2.3</td>
<td>AE, RE, Qigong; various intensities; 4w-6m</td>
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<tr>
<td>Wang 2014</td>
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<td>Substance use disorder; males and females; 38.9±5.8</td>
<td>AE, RE, Yoga, Tai Chi, sports; various intensities; 10d-6m</td>
<td>1) Depression (BDI, CES-D, Self-rating depression scale, HADS) 2) Anxiety (Self-rating scale, Hamilton Anxiety Scores, Mood and Physical Symptoms Scale-anxiety, STAI)</td>
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<tr>
<td>Wang 2019</td>
<td>12</td>
<td>516</td>
<td>Heart failure; males and females; mean±SD NR; range 43-74</td>
<td>AE, RE; various intensities; 8w-48w</td>
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<td>Weber 2020</td>
<td>37</td>
<td>3224</td>
<td>Older adults; males and females; 72.2±7.3</td>
<td>Tai Chi, Qigong, Yoga, Pilates; various intensities; 4w-1y</td>
<td>1) Depression (GDS, GDS-SF, HADS, BDI, BDI-II, CES-D, DASS-21, MHI-18, POMS, POMS-SF, Taiwanese Depression Questionnaire, Warwick-Edinburgh Mental Well-being Scale)</td>
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<tr>
<td>Wu 2019</td>
<td>6</td>
<td>415</td>
<td>COPD; males and females; 66.3±4.6</td>
<td>Qigong; various intensities; 4w-24w</td>
<td>1) Depression (Self-rating scale) 2) Anxiety (Self-rating scale)</td>
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<tr>
<td>Xiang 2017</td>
<td>10</td>
<td>689</td>
<td>Fatigue; males and females; mean±SD NR; range=18-88</td>
<td>Tai Chi; various intensities; 4w-6m</td>
<td>1) Depression (POMS, POMS-SF, IDS-C, CES-D, BDI, BDI-II)</td>
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<tr>
<td>Yi 2021</td>
<td>7</td>
<td>693</td>
<td>Breast cancer; females; 50.4±3.5</td>
<td>Yoga; various intensities; 8w-16w</td>
<td>1) Depression (BDI, POMS, HADS, Self-rating scale, CES-D) 2) Anxiety (POMS, HADS, Self-rating scale)</td>
<td>Critically low</td>
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<tr>
<td>Zeng 2019</td>
<td>12</td>
<td>915</td>
<td>Cancer; males and females; 62.2±4.3</td>
<td>Qigong; various intensities; 6w-12w</td>
<td>1) Depression (DASS, HADS) 2) Anxiety (DASS, HADS) 3) Stress (BSI, FACT-G)</td>
<td>Critically low</td>
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<td>Reference</td>
<td>Studies (n=)</td>
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<td>Population or condition; gender; age mean±SD or range (years)</td>
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<tr>
<td>Zeng 2014</td>
<td>13</td>
<td>592</td>
<td>Cancer; males and females; mean±SD and range NR</td>
<td>Tai Chi; various intensities; 6w-24w</td>
<td>1) Depression (BDI, CES-D)</td>
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<td>Zeng 2019</td>
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<td>Cancer; males and females; 52.5±4.1</td>
<td>AE, RE; various intensities; 8w-96w</td>
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<td>Critically low</td>
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<td>Zhang 2019</td>
<td>5</td>
<td>803</td>
<td>Older adults with mild cognitive impairment; males and females; 74.8±5.7</td>
<td>Tai Chi; various intensities; 12w-1y</td>
<td>1) Depression (CDS)</td>
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<tr>
<td>Zhao 2019</td>
<td>13</td>
<td>614</td>
<td>End-stage renal disease; males and females; 54.58±1.68</td>
<td>AR, RE, Yoga; various intensities; 8w-1y</td>
<td>1) Depression (BDI, HADS)</td>
<td>Critically low</td>
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<tr>
<td>Zhou 2021</td>
<td>8</td>
<td>570</td>
<td>Lung cancer; males and females; 64.4±2.1</td>
<td>AR, RE, Tai Chi; various intensities; 6w-12w</td>
<td>1) Depression (HADS, GHQ-12)</td>
<td>Critically low</td>
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<td>Zuo 2016</td>
<td>21</td>
<td>1762</td>
<td>Breast cancer; females; 42.6±4.7</td>
<td>Yoga; various intensities; 2w-24w</td>
<td>1) Depression (HADS, BDI, CES-D, DMI, Self-rating scale)</td>
<td>Critically low</td>
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</table>

Abbreviations:
AE: Aerobic exercise; RE: Resistance exercise; NR: Not reported
### eTable 3. AMSTAR 2 quality appraisal of reviews.

<table>
<thead>
<tr>
<th>Review</th>
<th>AMSTAR 2 Items</th>
<th>Overall confidence rating</th>
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<tr>
<td>Adamson</td>
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<td>Bergenthal</td>
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<td>Bradt 2015</td>
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<td>Bridle 2012</td>
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<td>Broderick 2015</td>
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<td>Brown 2012</td>
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<td>Carneiro 2020</td>
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<td>Carter 2019</td>
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Note: Y=yes; N=no; Partial Y=meets criteria for partial yes; N/A=not applicable as no meta-analysis conducted

Legend: AMSTAR 2 Items: 1) The Participant, Intervention, Comparator and Outcome (PICO) components included in the review research question and inclusion criteria; 2) Explicit statement included that review methods were established prior to conduct and significant deviations justified; 3) Selection of included study designs explained; 4) Comprehensive search strategy used; 5) Study selection performed in duplicate; 6) Data extraction performed in duplicate; 7) List of excluded studies with justification provided; 8) Included studies described in adequate detail; 9) Satisfactory technique used for assessing risk of bias in included studies; 10) Sources of funding for included studies reported; 11) Appropriate methods for statistical combination of results used if meta-analysis performed; 12) Potential impact of risk of bias of individual studies assessed if meta-analysis performed; 13) Risk of bias of individual studies accounted for in discussion of the review results; 14) Any heterogeneity observed in the review
results was explained and discussed; 15) Publication bias investigated and discussed if meta-analysis performed; 16) Authors reported any potential sources of conflict of interest.
eFigure 3. Results of meta-analyses that assessed depression using mean differences.

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Favours physical activity
Favours control

BDI: Beck Depression Inventory; CES-D: Center for Epidemiological Studies Depression; EPDS: The Edinburgh Postnatal Depression Scale; HADS: Hospital Anxiety and Depression Scale; MADRS: Montgomery-Asberg Depression Rating Scale; POMS: Profile of Mood States.
Table 4. Overview of results of meta-analyses using mean differences for anxiety and depression.

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eFigure 5. Results of meta-analyses that assessed anxiety using mean differences.

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<td>HADS</td>
<td></td>
</tr>
<tr>
<td>Pavey 2011</td>
<td>-4.12 [-11.52, 3.28]</td>
</tr>
<tr>
<td>Zhou 2021</td>
<td>-1.39 [-2.60, -0.18]</td>
</tr>
<tr>
<td>Zeng 2019A</td>
<td>-1.26 [-3.73, 1.20]</td>
</tr>
<tr>
<td>Zeng 2019B</td>
<td>-1.25 [-2.65, 0.15]</td>
</tr>
<tr>
<td>Peddle-McIntyre6 2019</td>
<td>-1.21 [-5.88, 3.45]</td>
</tr>
<tr>
<td>Van Haren 2013</td>
<td>-1.05 [-3.67, 1.57]</td>
</tr>
<tr>
<td>Guo 2020</td>
<td>-1.04 [-1.58, -0.51]</td>
</tr>
<tr>
<td>Fong 2012</td>
<td>-0.70 [-3.40, 2.10]</td>
</tr>
<tr>
<td>McGettigan 2020</td>
<td>1.79 [0.37, 3.94]</td>
</tr>
<tr>
<td>Zeng 2014</td>
<td>1.97 [-3.36, 7.31]</td>
</tr>
</tbody>
</table>

BSI-18: Brief Symptom Inventory-18; HADS: Hospital Anxiety and Depression Scale; STAI: The State-Trait Anxiety Inventory.
Figure 6. Results of subgroup meta-analyses for depression based on physical activity mode.
Figure 7. Results of subgroup meta-analyses for anxiety based on physical activity mode.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>Physical activity mode</th>
<th>SMD (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brubach 2015</td>
<td>Dance</td>
<td>0.21 [0.09, 0.54]</td>
</tr>
<tr>
<td>Duan 2020</td>
<td>Qigong</td>
<td>0.17 [0.11, 0.35]</td>
</tr>
<tr>
<td></td>
<td>Yoga</td>
<td>0.12 [0.05, 0.19]</td>
</tr>
<tr>
<td></td>
<td>Dance</td>
<td>-0.06 [-0.14, 0.02]</td>
</tr>
<tr>
<td>Gascon 2020</td>
<td>Mixed-mode</td>
<td>-0.16 [-0.50, 0.19]</td>
</tr>
<tr>
<td>Kelley 2015</td>
<td>Mixed-mode</td>
<td>-0.63 [-0.86, -0.40]</td>
</tr>
<tr>
<td>U 2019</td>
<td>Tai chi</td>
<td>-1.02 [-1.41, -0.64]</td>
</tr>
<tr>
<td></td>
<td>Qigong</td>
<td>-0.77 [-0.96, -0.59]</td>
</tr>
<tr>
<td></td>
<td>Yoga</td>
<td>-0.42 [-0.82, -0.03]</td>
</tr>
<tr>
<td>Pearse 2014</td>
<td>Aerobic</td>
<td>-0.26 [-0.91, 0.39]</td>
</tr>
<tr>
<td>Ramirez-Seijo, 2021</td>
<td>Aerobic</td>
<td>-0.25 [-0.55, 0.02]</td>
</tr>
<tr>
<td></td>
<td>Mixed-mode</td>
<td>-0.36 [-0.97, 0.27]</td>
</tr>
<tr>
<td>Ramos-Sanchez, 2021</td>
<td>Aerobic</td>
<td>-0.66 [-1.06, -0.26]</td>
</tr>
<tr>
<td></td>
<td>Resistance</td>
<td>-0.37 [-0.80, 0.06]</td>
</tr>
<tr>
<td></td>
<td>Mixed-mode</td>
<td>-0.32 [-0.34, 0.10]</td>
</tr>
<tr>
<td>Sethu 2021</td>
<td>Dance</td>
<td>-0.99 [-1.92, 0.05]</td>
</tr>
<tr>
<td>Singh 2018</td>
<td>Aerobic</td>
<td>-0.37 [-0.65, -0.09]</td>
</tr>
<tr>
<td></td>
<td>Resistance</td>
<td>-0.08 [-0.45, 0.30]</td>
</tr>
<tr>
<td></td>
<td>Mixed-mode</td>
<td>-1.36 [-1.62, -1.10]</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>-0.83 [-1.06, -0.61]</td>
</tr>
<tr>
<td>Singh 2020</td>
<td>Aerobic</td>
<td>-0.17 [-0.42, 0.09]</td>
</tr>
<tr>
<td></td>
<td>Mixed-mode</td>
<td>-0.34 [-0.63, -0.05]</td>
</tr>
<tr>
<td>Stallard 2017</td>
<td>Aerobic</td>
<td>-0.58 [-1.00, 0.05]</td>
</tr>
<tr>
<td>Wang 2014</td>
<td>Aerobic</td>
<td>-0.29 [-0.47, -0.13]</td>
</tr>
<tr>
<td></td>
<td>Mind-body</td>
<td>-0.23 [-0.57, -0.09]</td>
</tr>
<tr>
<td>Zhao 2019</td>
<td>Mixed-mode</td>
<td>-0.78 [-1.17, -0.41]</td>
</tr>
<tr>
<td>Zhuo 2016</td>
<td>Yoga</td>
<td>-0.42 [-0.57, -0.26]</td>
</tr>
</tbody>
</table>
Figure 8. Results of subgroup meta-analyses for depression based on physical activity intensity.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>Intensity</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellon 2021</td>
<td>Low</td>
<td>-0.22 [-0.56, 0.12]</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>-0.24 [-0.46, -0.02]</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>-0.28 [-0.66, 0.10]</td>
</tr>
<tr>
<td></td>
<td>Light</td>
<td>-0.39 [-0.53, -0.25]</td>
</tr>
<tr>
<td>Ramirez-Velez 2021</td>
<td>Moderate</td>
<td>-0.24 [-0.44, -0.04]</td>
</tr>
<tr>
<td></td>
<td>Moderate-to-vigorous</td>
<td>-0.28 [-0.66, 0.10]</td>
</tr>
<tr>
<td>Schuch 2016</td>
<td>Moderate</td>
<td>-0.73 [0.08, -1.38]</td>
</tr>
<tr>
<td></td>
<td>Vigorous</td>
<td>-1.15 [0.58, -2.80]</td>
</tr>
<tr>
<td>Schuch 2016</td>
<td>Light-to-moderate</td>
<td>-0.59 [-1.19, 0.02]</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>-1.33 [-2.39, -0.28]</td>
</tr>
<tr>
<td></td>
<td>Vigorous</td>
<td>-1.34 [-2.59, -0.09]</td>
</tr>
</tbody>
</table>
Figure 9: Results of subgroup meta-analyses for anxiety based on physical activity intensity.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>SMD (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramirez-Valle 2021</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>-0.47 [-0.72, -0.22]</td>
</tr>
<tr>
<td>Moderate-to-vigorous</td>
<td>-0.02 [-0.25, 0.21]</td>
</tr>
<tr>
<td>Ramos-Sanchez 2021</td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td>-0.26 [-0.69, 0.16]</td>
</tr>
<tr>
<td>Moderate-to-vigorous</td>
<td>-0.51 [-0.95, -0.07]</td>
</tr>
<tr>
<td>High</td>
<td>-0.44 [-0.78, -0.10]</td>
</tr>
</tbody>
</table>

Values represent standardized mean differences (SMD) with 95% confidence intervals (CI).
Figure 10: Results of subgroup meta analyses for depression based on intervention duration.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beline 2021</td>
<td>-0.68 [-0.90, -0.47]</td>
</tr>
<tr>
<td>≤12 weeks</td>
<td>-0.53 [-0.90, -0.17]</td>
</tr>
<tr>
<td>&gt;12 weeks</td>
<td>-0.45 [-0.87, -0.03]</td>
</tr>
<tr>
<td>Cantor 2019</td>
<td>-1.72 [-3.09, -0.39]</td>
</tr>
<tr>
<td>≤12 weeks</td>
<td>-0.52 [-0.94, -0.12]</td>
</tr>
<tr>
<td>&gt;12 weeks</td>
<td>-0.27 [-0.52, -0.02]</td>
</tr>
<tr>
<td>Chi 2013</td>
<td>-0.37 [-0.71, 0.00]</td>
</tr>
<tr>
<td>12 weeks</td>
<td>-0.27 [-0.52, -0.02]</td>
</tr>
<tr>
<td>24 weeks</td>
<td>-0.37 [-0.71, 0.00]</td>
</tr>
<tr>
<td>Knorr 2017</td>
<td>-0.92 [-1.60, -0.24]</td>
</tr>
<tr>
<td>&lt;10 weeks</td>
<td>-0.92 [-1.60, -0.24]</td>
</tr>
<tr>
<td>≥10 weeks</td>
<td>-0.69 [-1.10, 0.15]</td>
</tr>
<tr>
<td>Lawlor 2008</td>
<td>-1.80 [-3.20, -0.40]</td>
</tr>
<tr>
<td>&lt;8 weeks</td>
<td>-1.30 [-2.60, -0.00]</td>
</tr>
<tr>
<td>≥8 weeks</td>
<td>-0.60 [-1.10, 0.00]</td>
</tr>
<tr>
<td>Li 2019</td>
<td>-0.83 [-1.24, -0.42]</td>
</tr>
<tr>
<td>8-12 weeks</td>
<td>-0.90 [-1.32, -0.47]</td>
</tr>
<tr>
<td>24 weeks</td>
<td>-1.96 [-3.46, -0.47]</td>
</tr>
<tr>
<td>48 weeks</td>
<td>-1.36 [-2.56, -0.16]</td>
</tr>
<tr>
<td>Mishra 2012</td>
<td>-0.13 [-0.51, 0.24]</td>
</tr>
<tr>
<td>&lt;12 weeks</td>
<td>0.04 [-0.25, 0.33]</td>
</tr>
<tr>
<td>≥12 weeks</td>
<td>0.22 [-0.48, 0.92]</td>
</tr>
<tr>
<td>Patona 2017</td>
<td>-1.69 [-3.66, 0.28]</td>
</tr>
<tr>
<td>≤12 weeks</td>
<td>-0.13 [-0.47, 0.21]</td>
</tr>
<tr>
<td>&gt;12 weeks</td>
<td>0.04 [-0.25, 0.33]</td>
</tr>
<tr>
<td>Singh 2018</td>
<td>0.84 [-1.09, -0.65]</td>
</tr>
<tr>
<td>≤12 weeks</td>
<td>-0.84 [-1.09, -0.65]</td>
</tr>
<tr>
<td>&gt;12 weeks</td>
<td>-0.44 [-0.65, 0.23]</td>
</tr>
<tr>
<td>Singh 2020</td>
<td>-0.59 [-1.39, 0.22]</td>
</tr>
<tr>
<td>≤12 weeks</td>
<td>-0.59 [-1.39, 0.22]</td>
</tr>
<tr>
<td>&gt;12 weeks</td>
<td>0.55 [-0.70, 0.36]</td>
</tr>
<tr>
<td>Tu 2014</td>
<td>-0.50 [-0.73, -0.27]</td>
</tr>
<tr>
<td>&lt;12 weeks</td>
<td>-0.67 [-0.82, -0.53]</td>
</tr>
<tr>
<td>≥12 weeks</td>
<td>-0.12 [-0.20, 0.04]</td>
</tr>
</tbody>
</table>

Favours physical activity  Favours control
Figure 11: Results of subgroup meta-analyses for anxiety based on intervention duration.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>L 2019</td>
<td>-1.39 [-1.88, -0.90]</td>
</tr>
<tr>
<td>8-12 weeks</td>
<td>-0.82 [-1.06, -0.58]</td>
</tr>
<tr>
<td>24 weeks</td>
<td>-0.71 [-0.91, -0.50]</td>
</tr>
<tr>
<td>Mysken 2012</td>
<td>-0.26 [-0.44, -0.08]</td>
</tr>
<tr>
<td>&lt; 12 weeks</td>
<td>0.06 [-0.23, 0.35]</td>
</tr>
<tr>
<td>12 weeks to 6 months</td>
<td>-0.15 [-0.61, 0.30]</td>
</tr>
<tr>
<td>&gt; 6 months</td>
<td>-0.15 [-0.61, 0.30]</td>
</tr>
<tr>
<td>Singh 2018</td>
<td>-0.63 [-1.01, -0.25]</td>
</tr>
<tr>
<td>&lt; 12 weeks</td>
<td>-0.73 [-0.93, -0.53]</td>
</tr>
<tr>
<td>&gt; 12 weeks</td>
<td>-0.28 [-0.58, 0.03]</td>
</tr>
<tr>
<td>Singh 2020</td>
<td>-0.22 [-0.42, -0.02]</td>
</tr>
</tbody>
</table>

Favours physical activity vs favours control.
Figure 12: Results of subgroup meta-analyses for depression based on weekly duration.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berlin 2021</td>
<td>-0.34 [-0.51, -0.17]</td>
</tr>
<tr>
<td>Up to 150 minutes/week</td>
<td>-0.44 [-0.65, -0.22]</td>
</tr>
<tr>
<td>&gt;150 minutes/week</td>
<td>-0.20 [-0.40, 0.01]</td>
</tr>
<tr>
<td>Patou 2017</td>
<td></td>
</tr>
<tr>
<td>&lt;155 mins/week</td>
<td>-0.82 [-1.54, -0.10]</td>
</tr>
<tr>
<td>&gt;155 mins/week</td>
<td>0.66 [0.67, 0.74]</td>
</tr>
<tr>
<td>Ramirez-vizet 2021</td>
<td></td>
</tr>
<tr>
<td>&lt;350 mins/week</td>
<td>-0.24 [-0.45, -0.04]</td>
</tr>
<tr>
<td>&gt;350 mins/week</td>
<td>-0.36 [-0.38, 0.03]</td>
</tr>
<tr>
<td>Salihu 2021</td>
<td></td>
</tr>
<tr>
<td>&gt;150 mins/week</td>
<td>-0.65 [-0.39, -1.01]</td>
</tr>
<tr>
<td>&lt;150 mins/week</td>
<td>-0.72 [-1.07, -0.37]</td>
</tr>
<tr>
<td></td>
<td>-0.42 [-0.59, -0.25]</td>
</tr>
</tbody>
</table>

Favours physical activity | Favours control
Figure 13: Results of subgroup meta-analyses for anxiety based on weekly duration, session duration and session frequency.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>Weekly duration</th>
<th>Session duration</th>
<th>Session frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ramirez et al. 2021</td>
<td>≤150 min/week</td>
<td>30 to 60 min</td>
<td>2-3 sessions/week</td>
</tr>
<tr>
<td></td>
<td>≥150 min/week</td>
<td>60 to 90 min</td>
<td>4-5 sessions/week</td>
</tr>
<tr>
<td></td>
<td>≥150 min/week</td>
<td>60 to 90 min</td>
<td>6-7 sessions/week</td>
</tr>
</tbody>
</table>

SMD [95% CI]

-1.23 [-2.42, -0.04]  
-0.99 [-1.92, -0.05]  
-0.83 [-1.04, -0.61]  
-0.63 [-0.87, -0.40]  
-0.50 [-0.80, -0.30]  
-0.96 [-1.18, -0.74]  
-0.52 [-0.86, -0.18]

-3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1
Favours physical activity  
Favours control
Figure 14: Results of subgroup meta-analyses for depression based on session frequency.

<table>
<thead>
<tr>
<th>Study year</th>
<th>Sessions/week</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heissel 2020</td>
<td>1-3 sessions/week</td>
<td>-0.35 [-0.54, -0.16]</td>
</tr>
<tr>
<td></td>
<td>4-5 sessions/week</td>
<td>-0.32 [-0.69, 0.06]</td>
</tr>
<tr>
<td></td>
<td>6-7 sessions/week</td>
<td>-1.29 [-2.24, -0.34]</td>
</tr>
<tr>
<td>U 2019</td>
<td>1-3 sessions/week</td>
<td>-0.59 [-0.88, -0.29]</td>
</tr>
<tr>
<td></td>
<td>4-5 sessions/week</td>
<td>-0.85 [-1.34, -0.37]</td>
</tr>
<tr>
<td></td>
<td>6-7 sessions/week</td>
<td>-1.10 [-1.95, -0.26]</td>
</tr>
</tbody>
</table>

Favours physical activity: -
Favours control: +

Figure 15: Forest plot of the meta-analysis for depression based on session frequency.
Figure 15: Results of subgroup meta-analyses for depression based on session duration.

<table>
<thead>
<tr>
<th>Study, year</th>
<th>SMD [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bekke 2021</td>
<td></td>
</tr>
<tr>
<td>&lt;60 minute sessions</td>
<td>-0.41 [0.59, -0.24]</td>
</tr>
<tr>
<td>≥60 minute sessions</td>
<td>0.28 [0.54, -0.01]</td>
</tr>
<tr>
<td>Craft 2012</td>
<td></td>
</tr>
<tr>
<td>&gt;30 minute sessions</td>
<td>-0.57 [0.91, -0.23]</td>
</tr>
<tr>
<td>≤30 minute sessions</td>
<td>0.04 [0.20, 0.22]</td>
</tr>
<tr>
<td>U 2019</td>
<td></td>
</tr>
<tr>
<td>30-60 minute sessions</td>
<td>-0.78 [-1.62, -0.55]</td>
</tr>
<tr>
<td>60-90 minute sessions</td>
<td>-0.94 [-1.48, -0.40]</td>
</tr>
</tbody>
</table>

Favours physical activity Favours control