The Effectiveness of Second-Generation Mindfulness Interventions on Anxiety and Depression: A Systematic Review and Meta-Analysis

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Abstract

Background: Second-generation mindfulness-based interventions (SG-MBIs), which integrate ethical and moral practices, have emerged as promising treatments for depressive and anxiety symptoms. This meta-analysis aims to evaluate the effectiveness of SG-MBIs in reducing depression and anxiety among adults.

Methods: We conducted a meta-analysis of randomized controlled trials (RCTs) including adults from clinical populations, healthy adults, and mixed groups (e.g., individuals reporting psychological distress or physical health conditions without formal diagnoses). Databases searched included PubMed, Web of Science, and EBSCOhost (through April 2025). Effect sizes were computed using Hedges' g, calculated as the standardized mean differences between intervention and control groups at post-intervention, adjusted for small-sample bias, and synthesized under a random-effects model. Primary analyses focused on post-intervention outcomes, and additional analyses assessed long-term effects based on follow-up data from 20 trials (17 depression, 13 anxiety). In total, 43 studies on depression (n = 3,756) and 37 studies on anxiety (n = 3,199) were included. Moderator analyses tested participant type, control condition, intervention components, intervention type, primary outcome status and risk of bias status.

Results: SG-MBIs significantly reduced depressive (g = 0.59, 95% CI [0.41, 0.78]) and anxiety symptoms (g = 0.61, 95% CI [0.41, 0.81]); effects remained significant after outlier removal (depression: g = 0.44; anxiety: g = 0.40). Participant type significantly moderated outcomes, with clinical samples showing significantly larger improvements than both healthy and mixed samples. Intervention type also significantly moderated results. Control conditions, intervention components, outcome measures, primary outcome status, risk of bias status, and intervention duration were not significant moderators. Follow-up data (k = 20) indicated sustained depression reductions (g = 0.70). Most included trials were rated as having “some concerns” (n = 33), with 13 judged as low risk and 3 as high risk, suggesting that overall findings should be interpreted with caution. However, sensitivity analyses excluding these high-risk studies yielded similar results (depression: g = 0.61; anxiety: g = 0.64).

Conclusions: SG-MBIs effectively reduce depression and anxiety and may be particularly valuable for clinical populations and self-compassion–focused interventions. Future research should aim for clearer operational definitions, standardized intervention protocols, exploration of wisdom-based components, and adequately powered RCTs to strengthen the evidence base and enhance clinical applicability.

1.Introduction：

Depressive disorders are pervasive conditions that significantly reduce individuals' quality of life and social functioning, contributing to considerable morbidity and mortality (Cuijpers et al., 2020). Globally, about 5% of adults experience depression, translating to nearly 280 million people (World Health Organization, 2023). Although traditional treatments such as pharmacotherapy and psychotherapies (e.g., cognitive behavioral therapy, psychodynamic therapy) play essential roles in addressing depression and anxiety, they do not always yield optimal results (Leichsenring et al., 2022). Moreover, treatment access remains limited, particularly in low- and middle-income regions where over 75% of those needing help receive no formal care (Evans-Lacko et al., 2018). Consequently, there is a growing imperative to identify alternative or complementary interventions that can both enhance therapeutic effectiveness and increase availability.

Mindfulness-based interventions (MBIs) have shown promise in alleviating depressive and anxious symptoms (Khoury et al., 2013). The most widely recognized forms—often termed first-generation mindfulness-based interventions (FG-MBIs)—include mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT). These protocols emphasize cultivating non-judgmental awareness of the present moment (Kabat-Zinn, 1990; Segal et al., 2002). However, some scholars question whether FG-MBIs fully incorporate the ethical (sīla) and wisdom (prajñā) aspects of traditional Buddhist mindfulness (Purser & Loy, 2013; Ricard, 2013). They argue that when mindfulness is limited to mere attentional skill, it risks becoming "wrong mindfulness" (micchā sati) that lacks moral grounding (Senauke, 2013; Titmuss, 2013).

Early empirical research on Buddhist-derived meditation practices in the 1980s primarily investigated mindfulness meditation, conceptualized as cultivating nonjudgmental awareness of present experiences (Kabat-Zinn, 1990). This approach, distinct from mindfulness as a Buddhist philosophical construct, was popularized through MBIs and can be broadly categorized as concentration-based practices aimed at stabilizing the mind (Furnell et al., 2024b). In the early 21st century, scholars began integrating ethical and compassion-oriented elements into MBIs, introducing practices such as the Four Immeasurables—loving-kindness, compassion, empathetic joy, and equanimity—aligned with ethics-based training to counter unwholesome mental states (Van Gordon et al., 2019).

In response to these developments, Van Gordon et al. (2015) introduced the concept of Second-Generation Mindfulness-Based Interventions (SG-MBIs), which they define as "a process of engaging a full, direct, and active awareness of experienced phenomena that is (i) psycho-spiritual in aspect and (ii) maintained from one moment to the next." Compared with FG-MBIs, SG-MBIs aim to re-anchor mindfulness within a broader contemplative framework

by integrating ethical, compassion-based, and wisdom-oriented dimensions alongside attentional practices. These programs often include techniques such as Four Immeasurable Meditations (e.g., loving-kindness and compassion meditation), Emptiness Meditation, and structured reflective exercises designed to foster altruistic motivation and insight (Van Gordon & Shonin, 2020; Zheng et al., 2022). Rather than positioning mindfulness as a standalone attentional skill, SG-MBIs incorporate moral and philosophical elements to form a more holistic system and may require greater instructor competence to deliver these nuanced components effectively (Van Gordon & Shonin, 2020).

In a recent study, Furnell et al. (2024b) proposed a systematic classification of mindfulness practices using the Buddhist "three trainings" framework—ethics (*sīla*), concentration (*samādhi*), and wisdom (*prajñā*). Specifically, ethics refers to the practice of moral behaviors and the cultivation of compassion and virtuous actions; concentration involves meditation techniques aimed at stabilizing the mind and enhancing awareness; and wisdom emphasizes deeper insight into impermanence, non-self, and emptiness. Within this framework, first-generation mindfulness-based interventions (e.g., MBSR, MBCT) primarily emphasize concentration, second-generation interventions integrate ethical elements through compassion and loving-kindness practices, while third-generation interventions place greater emphasis on wisdom-oriented techniques such as emptiness meditation.

This meta-analysis adopts this framework and operationalizes SG-MBIs as structured interventions that extend first-generation protocols by explicitly incorporating ethical dimensions—typically incorporating practices such as loving-kindness meditation, compassion-focused interventions, mindful self-compassion and ethics-oriented related reflective exercises. These features distinguish SG-MBIs from interventions limited to attentional training and serve as the basis for our inclusion criteria. Such a comprehensive approach aims not only to alleviate depressive and anxious symptoms but also to foster positive emotions and prosocial behaviors (Kirby et al., 2017). Moreover, by emphasizing universal moral qualities, SG-MBIs may help address cross-cultural acceptability issues, thereby enhancing their broader applicability (Van Gordon et al., 2015). By contrast, third-generation mindfulness-based interventions (TG-MBIs) correspond to what Van Gordon et al. (2019) and Furnell et al. (2024a, 2024b) describe as wisdom-based approaches that emphasize insight (prajñā) training. These interventions cultivate meta-cognitive awareness and a transformation in one's view of self through meditations on non-attachment (Wu et al., 2019), emptiness (Van Gordon et al., 2019), interdependence of all beings (Geiger et al., 2020), and non-duality (Johnson, 2017). Operationally, TG-MBIs differ from SG-MBIs in placing wisdom and direct realization at the core of practice, rather than the ethical and compassion-based components that characterize SG-MBIs.

Recent theoretical and empirical work suggests that SG-MBIs may offer unique

advantages over traditional MBIs by targeting mechanisms beyond attentional training. These programs explicitly cultivate self-compassion, which reduces self-criticism and shame by activating the parasympathetic "soothing system" (Leaviss & Uttley, 2015; Kirby et al., 2017). They also foster positive affect and psychological well-being by integrating compassion- and kindness-based practices (Fredrickson et al., 2008), and they foster interpersonal connectedness and prosocial behaviors—addressing social risk factors underrepresented in earlier MBIs (Van Gordon & Shonin, 2020; Chen & Jordan, 2020). Meta-analytic findings further support their efficacy in improving emotional regulation, self-compassion, and well-being, particularly among vulnerable populations (Kirby et al., 2017; Ferrari et al., 2019).

Several interventions exemplify the defining characteristics of SG-MBIs. Early representative programs include Meditation Awareness Training (MAT; Van Gordon et al., 2013) and Mindfulness-Based Positive Behavior Support (MBPBS; Singh et al., 2014), while more recent developments include Mindfulness-Based Positive Psychology (MBPP; Zhou et al., 2021). Additionally, compassion-focused programs such as Compassion Cultivation Training (CCT; Rojas et al., 2023), Cognitively-Based Compassion Training (CBCT; Aguilar-Raab et al., 2023), and Mindful Self-Compassion (MSC; Neff & Germer, 2013) are often classified as SG-MBIs because they explicitly integrate ethical reflection and compassion cultivation (Chen & Jordan, 2020). Accumulating evidence indicates that these approaches not only alleviate symptoms but may also promote prosocial attitudes, interpersonal connectedness, and spiritual well-being (Shonin et al., 2014; Zheng et al., 2022), further underscoring their potential as comprehensive models for mental health promotion (Zhou et al., 2024). These interventions exemplify the SG-MBI model described in our conceptual framework, which emphasizes an ethical foundation—encompassing moral behaviors, compassion cultivation, and virtuous actions—as a core component. The current meta-analysis targets these intervention categories as the primary focus for data collection and analysis.

Preliminary studies suggest that SG-MBIs may surpass traditional MBIs in improving emotional regulation, reducing negative affect, and enhancing well-being (MacBeth & Gumley, 2012; Shonin et al., 2014). However, much of the existing literature either focuses on first-generation interventions or examines narrow facets of SG-MBIs, such as compassion meditation alone (Kirby et al., 2017; Galante et al., 2014; Lv et al., 2020). A comprehensive synthesis that evaluates a range of SG-MBIs, particularly their ethical and moral components, is still lacking (Goldberg et al., 2018; Khoury et al., 2013). This gap makes it difficult to ascertain whether the purported additional elements of SG-MBIs lead to more robust or longer-lasting improvements in depression and anxiety. Addressing this gap is crucial for guiding the design of more effective mindfulness-based therapies.

Although some RCTs have demonstrated the efficacy of SG-MBIs in alleviating depressive and anxious symptoms, there is still a need for a meta-analysis to integrate findings

from various studies and provide a unified conclusion. Many studies have investigated the effectiveness of SG-MBIs but have often focused on specific aspects, such as compassion training or loving-kindness meditation, without considering the full spectrum of SG-MBIs. Thus, conducting this meta-analysis is essential to integrate findings from a variety of studies, resolve the lack of clarity in the results, and provide a clearer understanding of the overall impact of SG-MBIs on mental health.

Therefore, the purpose of this meta-analysis is to evaluate the effects of SG-MBIs on depressive and anxious symptoms among adults, with an emphasis on interventions that integrate ethical and moral practices. This study aims to quantify the overall effect size across a variety of SG-MBI protocols, compare distinct subtypes, and examine potential moderators such as participant characteristics and intervention duration. By synthesizing evidence from randomized controlled trials, we hope to clarify how integrating ethics and compassion might strengthen the impact of mindfulness-based approaches. The findings of this study will not only shed light on the mechanisms by which SG-MBIs alleviate depressive and anxious symptoms but also inform clinical practice and future research directions. Ultimately, the goal is to promote more comprehensive and culturally adaptable mindfulness interventions that address the global burden of depression and anxiety.

Previous studies have suggested that the effectiveness of these interventions may be influenced by several factors, including participant characteristics, control conditions, and the specific components of the intervention used (Van Gordon & Shonin, 2020). Understanding which moderators influence the outcomes of SG-MBIs is crucial for refining their application and enhancing their impact. As such, this study aims to explore several potential moderators, grounded in both theoretical frameworks and existing literature, to better understand how factors such as participant type, control conditions, intervention components, and outcome measures may affect the efficacy of SG-MBIs.

To clarify how and for whom second-generation mindfulness-based interventions (SG-MBIs) work, we considered seven study features that theory and prior evidence suggest can shape outcomes. Participant characteristics matter: clinical samples often show larger gains than non-clinical ones, presumably because baseline symptom severity leaves more room for improvement (Khoury et al., 2013). Comparison conditions are also influential, as passive controls (e.g., wait-list) typically inflate effects relative to active controls that contain therapeutic ingredients of their own (Hofmann et al., 2010).

Emerging evidence suggests that self-compassion and compassion for others, while both central to compassion-based interventions, may operate through distinct mechanisms and yield differential intrapersonal and interpersonal benefits, underscoring the importance of examining them separately in intervention research (Cha et al., 2023). We also examined specific

intervention type, as standardized SG-MBI protocols such as MSC, CFT, CBCT, and CCT vary in theoretical emphasis and practice structure, which may lead to differential effects (Neff & Germer, 2013; Kirby et al., 2017; Lang et al., 2020; Rojas et al., 2023).

Variation in outcome instruments (for instance, DASS-21 versus BDI-II) can further modulate apparent efficacy because some scales are more sensitive to change than others (Meesters et al., 2021), and primary outcome status, given that trials designating depression or anxiety as the main endpoint may achieve higher precision and stronger effects than those treating them as secondary outcomes (Andrade, 2015). Finally, the methodological quality of trials, indexed with the Cochrane RoB 2 tool, influences confidence in any pooled estimate; studies at high risk of bias tend to report larger, less reliable effects (Sterne et al., 2019). By examining these seven moderators, the present meta-analysis seeks not only to quantify overall benefits of SG-MBIs for adult depression and anxiety but also to explain the heterogeneity that has characterized this growing literature.

2. Methods

2.1 Literature Search

This meta-analysis was prospectively registered in the PROSPERO International Prospective Register of Systematic Reviews (Registration No: CRD42025612815; Zhang & Xu, 2024), in compliance with PRISMA guidelines. Details of deviations from the PROSPERO registration and the PRISMA checklist are provided in Supplement S1.

A comprehensive search strategy was used to identify all SG-MBI studies published in English before April 4, 2025, examining their effects on depressive and anxiety symptoms. The databases used include PubMed, Web of Science, EBSCOhost (Psychology collection, including PsycINFO, PsycArticles, Psychology and Behavioral Sciences Collection, Academic Search Premier). The search query was based on titles, keywords and abstracts, with the keywords “Second generation mindfulness-based intervention OR SG-MBI OR Loving kindness meditation OR Compassion meditation OR Meditation awareness training OR Ethics-oriented mindfulness training OR Mindfulness-Based Positive Behavior Support OR Mindfulness -Based Positive Psychology OR Mindful Self-Compassion OR Compassion Cultivation Training OR Cognitively-Based Compassion Training AND ("Randomized controlled trial" OR "RCT"), and after adjusting for different databases, obtain all studies that may meet the systematic review after excluding duplicates. These terms reflect the operationalization of SG-MBIs as interventions that embed ethical or compassion-based elements.

2.2 Selection of studies

Inclusion Criteria:(a) Population: Adults aged 18-60 with symptoms of depression or anxiety; (b) Intervention: Second-generation mindfulness-based interventions (SG-MBIs),

defined as structured programs that explicitly or implicitly integrate ethical or moral dimensions—such as compassion or loving-kindness—beyond basic mindfulness and attention regulation. Eligible interventions typically include one or more of the following components: loving-kindness practices (e.g., Loving-Kindness Meditation); compassion-focused practices (e.g., Compassion Meditation, Cognitively-Based Compassion Training); self-compassion training (e.g., Mindful Self-Compassion); and ethics-oriented reflective exercises or teachings (e.g., cultivating non-harming, altruistic intention, or values-based awareness). Programs that are limited to attentional training without these ethical or moral elements were excluded from this analysis; (c) Study Design: Randomized controlled trials (RCTs); (d) Outcomes: Studies must include measures of mental health outcomes (e.g., depression and/or anxiety)

Exclusion Criteria：(a) Review or Background Articles: Exclude reviews, background articles, and non-empirical literature; (b) Wrong Intervention: Exclude studies using first-generation mindfulness interventions (e.g., MBSR, MBCT) or non-mindfulness psychological therapies as the primary intervention; these may only serve as control conditions. The experimental group must utilize a second-generation mindfulness intervention; (c) Wrong Population: Exclude studies involving participants outside the age range of 18–60; (d) Wrong Study Design: Exclude non-RCT studies, such as single-group or observational designs; (e) Not Related: Exclude studies that do not report pre- and post-intervention data on validated measures of depression or anxiety, either as primary or secondary outcomes.

Two reviewers independently screened the titles and abstracts of all identified records to assess preliminary eligibility. Full-text articles were then retrieved and independently evaluated against the inclusion criteria. Discrepancies between reviewers were resolved through discussion, and a third reviewer was consulted when consensus could not be reached. To ensure completeness, we manually checked the reference lists of included studies and relevant SG-MBI reviews for additional eligible trials. To enhance transparency in our classification process, we compiled a supplemental table (Supplement S2) that lists each program's key characteristics and the specific SG-MBI components that warranted its inclusion under the SG-MBI framework.

2.3 Data Extraction and coding

Hedges' g (Hedges & Vevea, 1998) served as the primary effect size, calculated as the standardized mean difference between intervention and control groups at post-intervention and adjusted for small-sample bias. Standard errors were computed for each study to facilitate meta-analytic weighting. Random-effects models were applied to account for between-study heterogeneity, with τ^2 estimated using the DerSimonian and Laird (DL) method. Analyses incorporated sample sizes, means, and standard deviations from intervention and control groups and were conducted using the metafor package in R.

Studies were retained only if they provided sufficient descriptive statistics (i.e., post-

intervention means and standard deviations for both groups). When these data were incomplete, study authors contacted corresponding authors to request the necessary information. Studies were excluded only if the required data could not be obtained. Study data were coded for participant type (e.g., Adults Healthy, Adults Clinical, Adults Mixed), control conditions (e.g., active control, passive control), intervention components (e.g., self-compassion, other-compassion, others), outcome measures for depressive and anxiety symptoms, whether depression/anxiety was the primary outcome (primary vs. non-primary), and overall risk of bias (low, some concerns, high).

Risk of bias was assessed using the revised Cochrane Risk of Bias tool for randomized trials (RoB 2; Sterne et al., 2019), encompassing five domains: randomization, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. Two independent coders evaluated all studies. To assess inter-rater reliability, we calculated the quadratic weighted Cohen's Kappa (Landis & Koch, 1977), which accounts for the ordinal nature of RoB ratings. Discrepancies were resolved through discussion or consultation with a senior reviewer.

To improve interpretability, minimally important differences (MIDs) were estimated using a distribution-based approach, operationalized as 0.5 times the baseline standard deviation of the intervention group in each study, a commonly used method in health-related quality of life research (Norman et al., 2003). For each outcome measure, weighted average MIDs were computed using the intervention group's baseline sample size as the weight.

2.4 Meta-analytic strategy

This meta-analysis was conducted using a random-effects model (Hedges & Vevea, 1998) with between-study variance estimated by the DerSimonian–Laird method. All analyses were performed in R (version 4.4.2) using the metafor package (Viechtbauer, 2010). The primary effect size was Hedges' g, representing the standardized mean difference between intervention and control groups adjusted for small-sample bias (Hedges & Olkin, 1985). For post-intervention and follow-up outcomes, Hedges' g was computed from the difference in group means standardized by the pooled standard deviation, with positive values indicating greater improvement in the intervention group. Ninety-five percent confidence intervals (CIs) were calculated using normal approximation.

Heterogeneity was assessed using Q-tests, I^2, and τ^2 (Higgins et al., 2003). To explore potential sources of heterogeneity, both subgroup analyses and meta-regression were conducted. Subgroup analyses descriptively reported pooled effect sizes (Hedges' g), 95% confidence intervals (CIs), and heterogeneity (I^2) for each level of categorical moderators, including participant type, control condition, intervention component, intervention type, and outcome measure. Meta-regression was performed using the *metafor* package in R, with categorical

moderators entered as factors and continuous moderators (e.g., intervention duration) retained as numeric variables. The significance of categorical moderators was tested using omnibus QM statistics, whereas continuous moderators were examined using model-based F-tests.

Moderator analyses were conducted to determine whether specific characteristics could explain heterogeneity. To ensure the statistical validity of the moderator analyses, the variables were coded as follows:

(1) Participant Type included: Adults Healthy (a), Adults Clinical (b), Adults Mixed (c). (2) Control Conditions included: active control group (a), passive control group (b) (3) Measures were grouped based on coded levels, with instruments used more than two trials and their variations or shorter versions categorized under the same group. For instance, the Beck Depression Inventory (BDI) and BDI-II were grouped together, the 21-item and 42-item versions of the Depression Anxiety and Stress Scale (DASS) were treated as a single category, and Patient Health Questionnaire-8 (PHQ-8) and Patient Health Questionnaire-9 (PHQ-9) were grouped into the same category. (4) Intervention Component: Self-Compassion (a), Other-Compassion (b), Others (c). (5) Specific Intervention Type included standardized SG-MBI programs that appeared in at least two trials (e.g., MSC, CFT, CBCT, LKM, CCT), enabling subgroup and meta-regression analyses. (6) Primary Outcome Status: Whether depression and/or anxiety symptoms were identified as the primary outcome of the trial: Primary (a) and Non-Primary (b). (7) Risk of Bias Status: Classified according to the Cochrane Risk of Bias 2 (RoB 2) tool into three categories: Low risk (a), Some concerns (b), High risk (c).

For the classification of Participant Type, the "Adults Clinical" category was defined based on either (1) a formal clinical diagnosis according to DSM, ICD, or MINI criteria; (2) inclusion criteria requiring participants to meet clinical thresholds on validated measures such as HDRS (≥12), BDI-II (≥15), HADS-Anxiety (≥8), PHQ-9 (M ≥15), or BSI-18 (>64); or (3) a clearly described treatment-seeking sample or participants currently in psychiatric or psychological care.

The "Adults Mixed" category included participants without formal diagnoses, but whose inclusion criteria required self-reported psychological distress or subclinical symptoms; (1) this included individuals reporting moderate depressive or anxiety symptoms, (2) studies with mixed physical or psychosocial populations (e.g., cancer patients, parents of children with ADHD, dermatology patients), and (3) samples with elevated baseline symptom scores (e.g., PHQ-9, GAD-7, DASS-21) that were not used as inclusion criteria.

The "Adults Healthy" category referred to participants without psychiatric diagnoses or clinical symptom thresholds, and (1) studies in this category explicitly excluded individuals with any diagnosed mental health conditions, (2) baseline symptom scores were low or within normal range, and (3) samples were drawn from general populations such as university students,

medical trainees, or healthy community adults.

Post hoc power analyses were conducted using metapower (Griffin, 2021), based on observed effect sizes from meta-regression models, to assess whether the included studies provided adequate power across levels of heterogeneity.

For clinical interpretability, Number Needed to Treat (NNT) was estimated using Furukawa's (1999) conversion formula, assuming a binormal distribution and equal variances. Because few studies reported response rates, we used a conservative control event rate (CER) of 17%, consistent with prior psychotherapy meta-analyses (Cuijpers et al., 2021).

2.5 Assessment of Publication Bias and Outlier Influence

To assess potential publication bias, we conducted Egger's regression test using the standard error of effect sizes as the predictor in a mixed-effects meta-regression model (Sterne & Egger, 2001). This analysis was performed prior to outlier exclusion to preserve the original distribution of data and enhance the sensitivity of asymmetry detection. We further conducted Trim-and-Fill analysis (Duval & Tweedie, 2000) to estimate the number of potentially missing studies due to publication bias. This procedure was also carried out before removing extreme values, and the adjusted overall effect size was reported accordingly.

In addition, we examined the 95% confidence intervals of each study's effect size against the overall pooled estimate. Studies whose confidence intervals did not overlap with the 95% CI of the overall effect were flagged as statistical outliers and excluded in a subsequent sensitivity analysis (Harrer et al., 2021). To facilitate visual inspection, we generated a series of funnel plots, including: (a) the funnel plot of all included studies; (b) the funnel plot after removing outliers. We also created scatter plots of effect size versus standard error, overlaid with the Egger's regression line, to visually assess small-study effects.

Finally, to further evaluate the robustness of our findings, we conducted additional sensitivity analyses by excluding studies rated as having a high overall risk of bias according to the RoB 2 tool. After these exclusions, pooled effect sizes were recalculated for both depression and anxiety outcomes to determine whether the main conclusions were sensitive to study quality.

Individual study estimates and pooled results were presented using forest plots. Publication bias was visually assessed using funnel plots. Study characteristics and risk of bias assessments were summarized in structured tables. All plots were generated using the metafor and meta packages in R.

3. Results

3.1 Search results and characteristic of studies

The literature search flowchart is shown in Fig.1. A total of 2179 records were identified from database searches. After the removal of 556 duplicate records, 1623 records were screened based on their titles and abstracts. Of these, 1507 records were excluded due to reasons such as wrong intervention (n = 541), wrong study design (n = 298), not related (n = 241), review or background articles (n = 289), and wrong population (n = 138). Subsequently, 116 full-text articles were assessed for eligibility, with 67 excluded for reasons including wrong intervention (n = 35), duplicate records (n = 2), not related (n = 9), wrong study design (n = 8), wrong population (n = 1), and lack of relevant data (n = 12). Ultimately, 49 studies were included in the meta-analysis.

The risk of bias for these studies was independently assessed by two reviewers using the revised Cochrane Risk of Bias Tool for Randomized Trials (RoB 2; Sterne et al., 2019), with discrepancies resolved through discussion. Inter-rater reliability for the risk of bias assessment was substantial, with a quadratic weighted Cohen's Kappa of 0.852 ($p < .001$), indicating strong agreement between reviewers (Landis & Koch, 1977). Across all studies, most were rated as having some concerns—primarily due to outcome measurement and selective reporting—while three studies were judged to be at high risk of bias. These factors may influence the certainty of the estimated effects and should be considered when interpreting the findings. A visual summary of domain-level ratings across all included studies is presented in Figure 2, while detailed assessments for individual studies are provided in Table 2.

The key characteristics and main findings of the included randomized controlled trials are presented in Table 1. Across the included studies, the weighted mean age of participants was 37.43 years (SD = 14.05), and the weighted average proportion of female participants was 77.77%.

3.2 Meta-analyses for randomized controlled trials

3.2.1. Study characteristics and data overview

For depression, 43 studies involving 3,756 participants provided 43 independent effect sizes. For anxiety, 37 studies involving 3,199 participants yielded 37 independent effect sizes. Characteristics of depression studies are summarized in Table 3, and those for anxiety studies in Table 4.

3.2.2. Overall Effects

The weighted average effect size across 43 independent effect sizes for depression was Hedges' g = 0.59 (95% CI = [0.41, 0.78], 95% PI = [–0.55, 1.83], NNT = 5.3, $p < .0001$), indicating a moderate effect of the intervention in reducing depressive symptoms. The forest plot (Fig. 3) illustrates considerable variation among individual effect sizes. Heterogeneity was high (Q (42) = 278.13, $p < .0001$; $I^2 = 84.90\%$; $\tau^2 = 0.29$), warranting further analyses to identify potential moderators.

The weighted average effect size across 37 independent effect sizes for anxiety was Hedges' g = 0.61 (95% CI = [0.41, 0.81], 95% PI = [–0.56, 1.83], NNT = 5.1, $p < .0001$), reflecting a moderate reduction in anxiety symptoms following the intervention. The heterogeneity analysis indicated substantial variability among studies (Q (36) = 248.97, $p < .0001$; $I^2 = 85.54\%$; $\tau^2 = 0.32$). These results suggest that, although the overall effect was significant, the presence of considerable heterogeneity underscores the need for further exploration of moderators. The forest plot (Figure 4) illustrates this variation.

As shown in Figure 5, the depression funnel plot appeared asymmetric, and Egger's regression indicated significant bias ($z = 6.91$, $p < .0001$) (Fig. 6). However, the Trim-and-Fill procedure did not impute any missing studies, and the pooled effect size remained unchanged (g = 0.59, 95% CI [0.41, 0.78]), NNT = 5.3, indicating no evidence of publication bias. Based on confidence interval non-overlap, 10 outlier studies were identified and removed. After excluding these, the effect size dropped to $g = 0.44$ (95% CI [0.35, 0.52], NNT = 7.5, $p < .0001$), with substantially reduced heterogeneity ($I^2 = 21.1\%$) (Fig. 7).

Similarly, the anxiety funnel plot suggested asymmetry (Fig. 8), and Egger's regression test confirmed significant small-study effects ($z = 4.78$, $p < .0001$) (Fig. 9). The Trim-and-Fill analysis again yielded no additional studies, leaving the pooled effect size unchanged (g = 0.61, 95% CI [0.41, 0.81], NNT = 5.1). Nine outliers were identified and removed, resulting in a reduced effect size of g = 0.40 (95% CI [0.32, 0.49], NNT = 8.4, $p < .0001$) and eliminating heterogeneity ($I^2 = 0\%$) (Fig. 10).

Although sensitivity analyses removing outliers retained statistical significance, the presence of asymmetry suggests potential small-study effects, and findings should be interpreted cautiously.

To further test robustness, we conducted sensitivity analyses excluding studies rated as having high overall risk of bias (two for depression and three for anxiety). Results remained significant after exclusion: depression (k = 41) yielded Hedges' g = 0.61 (95% CI [0.42, 0.81], 95% PI [–0.55, 1.83], NNT = 5.1, $p < .0001$; $I^2 = 85.58\%$), and anxiety (k = 34) yielded Hedges' g = 0.64 (95% CI [0.42, 0.86], 95% PI [–0.56, 1.83], NNT = 4.8, $p < .0001$; $I^2 = 86.54\%$). These findings indicate that the main conclusions are robust even after excluding high-risk trials.

3.2.2.1. Clinical Significance of Outcome Changes

In addition to statistical effect sizes, we evaluated whether the observed symptom reductions met established thresholds for clinical meaningfulness (i.e., MID/MCID). Table 5 presents the weighted MID values for each scale, calculated using a distribution-based method (0.5 × baseline SD of the intervention group), alongside published benchmarks for clinically meaningful change.

For depressive outcomes, weighted MIDs ranged from 1.91 (HADS-D) to 4.52 (BDI-II). The MID for BDI-II (4.52) fell within the established clinically meaningful change (CMC) range of 3–6 points (Hengartner & Plöderl, 2022), suggesting clinically significant improvement. Similarly, HDRS (3.73), PROMIS Depression (4.00), and HADS-D (1.91) all exceeded their respective MCID thresholds (HDRS: 3–5 points; PROMIS: T-score change of 3–4; HADS-D: 1.5–1.7 points), indicating clinically meaningful change (Kroenke et al., 2020; Smid et al., 2017). By contrast, the MIDs for DASS-21 (2.72) and CES-D (5.35) were considerably below their respective MCIDs (5 and 9 points), indicating that observed changes may not have reached clinical significance (Yohannes et al., 2022; Haase et al., 2016).

For anxiety outcomes, the MID for PROMIS (3.68) exceeded the established CMC threshold of 3–4 points (Kroenke et al., 2020), while HADS-A (1.68) fell within its MCID range of 1.3–1.8 (Smid et al., 2017), suggesting meaningful improvements in both. In contrast, the MID for STAI (4.14) was far below the 10-point threshold (Corsaletti et al., 2014), raising concerns about clinical interpretability. Notably, the STAI MID was derived from a smoking population, and its generalizability may be limited. The DASS-21 Anxiety MID (2.32) and GAD-7 (2.22) also fell short of their respective MCIDs (5 and 3.3 points; Yohannes et al., 2022; Bauer-Staeb et al., 2021).

Overall, while several weighted MIDs exceeded or approached established MCID benchmarks (e.g., BDI-II, HDRS, HADS-D, PROMIS Depression and Anxiety, HADS-A), others (e.g., DASS-21, CES-D, STAI, GAD-7) fell below clinically meaningful thresholds, suggesting that not all symptom reductions in SG-MBI studies may translate into clinically significant improvements across outcome measures.

3.2.3. Moderator analysis

Subgroup and meta-regression analyses were conducted to explore potential moderators of SG-MBI effects on depression and anxiety (see Table 6 for detailed results).

For depressive symptoms, significant moderation effects were found for participant type (QM (2) = 8.66, p = .01) and intervention type (QM (5) = 11.57, p = .04). Clinical populations (g = 1.22) showed significantly larger improvements than both healthy (g = 0.34) and mixed samples (g = 0.42). Among intervention types, Mindful Self-Compassion (MSC) produced the highest effect (g = 1.14), with moderate effects observed for Loving-Kindness (LKM, g = 0.52) and Compassion Cultivation (CCT, g = 0.45). Other moderators—including control group type, intervention component, outcome measure, primary-outcome status, risk-of-bias, and intervention duration—were non-significant.

For anxiety symptoms, participant type (QM (2) = 7.03, p = .03) and intervention type (QM (3) = 12.72, p = .005) again emerged as significant moderators. Clinical samples (g = 1.26) showed significantly larger effects than both healthy (g = 0.42) and mixed samples (g = 0.48).

MSC interventions (g = 1.35) yielded the largest effects among intervention types, whereas other moderators showed no significant influence.

To evaluate the adequacy of the moderator analyses, we conducted post hoc power analyses using the metapower package (Griffin, 2021). As shown in Table 6, among the 14 tested moderators, four reached statistical significance based on QM tests: participant type for depression (p = .01), participant type for anxiety (p = .03), intervention type for depression (p = .04), and intervention type for anxiety (p = .005). However, post hoc power analysis revealed a mixed picture. Participant type for depression demonstrated adequate statistical power (power = 0.83), meeting Cohen's (1988) recommended threshold of 0.80, indicating that this significant finding is likely robust. In contrast, participant type for anxiety exhibited only moderate power (power = 0.68), suggesting an elevated risk of Type II error due to lower power. Both intervention type moderators had extremely low power (power < 0.20), raising concerns that their significant QM tests may be unstable and should be interpreted cautiously.

For the remaining moderators—control group type, intervention component, outcome measure, primary outcome status, and risk of bias status—none reached statistical significance (p > .05). Notably, these analyses were severely underpowered, with power estimates ranging from 0.09 to 0.83, with a mean power of 0.26, well below the conventional 0.80 benchmark. This substantial power deficit implies that the absence of significant effects may reflect insufficient sensitivity rather than the absence of true moderation. It is also possible that small effect sizes contributed to the low power. However, post hoc power analysis suggests that power for testing these moderators was likely low, and there is an increased risk of Type II error. This is common in meta-analyses, including meta-analyses of mindfulness-based interventions (MBIs) (Hedges & Pigott, 2001; Goldberg et al., 2022). Consequently, non-significant results for these moderators should not be considered conclusive. Future studies with larger samples and more balanced subgroup representation are needed to clarify the role of these moderators and enhance the precision of moderation estimates.

3.3. Long-Term Follow-Up Effects

3.3.1. Overall Follow-Up Effects

A total of 20 randomized controlled trials were included in the follow-up analyses, comprising 17 trials for depression (n = 1,397) and 13 trials for anxiety (n = 999). For depression, the pooled effect size at follow-up was g = 0.70 (95% CI [0.35, 1.04], 95% PI [-0.65, 2.04], p < .0001, NNT = 4.4, I^2 = 87.8%), indicating a moderate and statistically significant reduction in depressive symptoms that was maintained over time. For anxiety, the overall follow-up effect was g = 0.34 (95% CI [-0.13, 0.81], 95% PI [-1.32, 2.00], NNT = 10.0, p = .16) with high heterogeneity (I^2 = 90.4%). These findings suggest that SG-MBIs may help maintain improvements in anxiety symptoms over time; however, the effect did not reach statistical significance and showed considerable variability across trials.

3.3.2. Subgroup Analyses for Follow-Up Effects

For depressive symptoms, participant type significantly moderated long-term effects (QM (2) = 17.16, $p < .001$). Clinical populations showed the largest effect (g = 3.05, 95% CI [0.31, 5.80], $p = .029$), followed by mixed samples (g = 0.47, 95% CI [0.14, 0.80], $p = .006$), whereas healthy participants were nonsignificant (g = 0.18, $p = .360$). Control group type did not significantly moderate effects (QM (1) = 0.90, $p = .344$); however, passive control trials yielded significant effects (g = 0.78, 95% CI [0.42, 1.14], $p < .001$), whereas active control trials did not (g = 0.58, $p = .137$). Intervention component was also not a significant moderator (QM (2) = 1.05, $p = .592$), although all components showed significant effects: self-compassion (g = 1.03, $p = .018$), other-compassion (g = 0.36, $p = .002$), and others (g = 0.68, $p = .007$).

For anxiety symptoms, neither control group type (QM (1) = 3.39, $p = .066$) nor intervention component (QM (2) = 0.37, $p = .833$) significantly moderated follow-up effects. Passive control conditions demonstrated a significant long-term effect (g = 0.63, 95% CI [0.33, 0.93], $p < .001$), whereas active control did not (g = −0.21, $p = .743$). Among intervention components, significant effects were observed for other-compassion (g = 0.42, $p = .001$) and others (g = 0.49, $p < .001$), whereas self-compassion was nonsignificant (g = 0.16, $p = .778$). Detailed subgroup and meta-regression results for follow-up outcomes are provided in Table 7.

As shown in Table 7, only participant type for depression demonstrated adequate statistical power (power = 0.9999), indicating robust evidence for this moderator. In contrast, all other moderators—control group type and intervention component for both depression and anxiety—showed extremely low power (power ≤ 0.30), far below the conventional 0.80 threshold (Cohen, 1988). This suggests that their nonsignificant QM tests may reflect insufficient sensitivity rather than the absence of true moderation effects. Consequently, interpretations for these moderators should remain cautious. Future studies with larger samples and balanced subgroup representation are warranted to enhance precision and reduce the risk of Type II error.

4. Discussion

4.1. Current status of research on SG-MBIs and overall effects

The results of the literature search showed that the number of studies on second-generation mindfulness-based intervention (SG-MBI) has increased significantly in recent years, but the overall research is still in the preliminary development stage. Especially in the past five years, the number of related studies has surged, accounting for 55% of all included studies, reflecting the rapid growth and widespread attention of research in this field. Among the included studies, 43 focused on depression as a variable, and 37 on anxiety, involving 3,756 and 3,199 participants respectively, highlighting that depression and anxiety symptoms remain the most frequently assessed indicators in SG-MBI research. This review synthesizes current evidence through meta-analysis to provide an updated overview of the effectiveness of SG-MBIs in

improving mental health.

Overall, the results indicate that SG-MBIs are effective in reducing both depressive and anxiety symptoms. For depression, participant type emerged as a key moderator, with clinical populations demonstrating the greatest improvements compared to mixed and healthy samples. Intervention type also contributed to outcome variability, with self-compassion–oriented programs showing more favorable effects than other SG-MBI formats (e.g., CBCT, CFT, CCT). Other factors, such as control condition, intervention component, and intervention duration, did not consistently moderate effects.

For anxiety, participant type again proved significant, with clinical groups experiencing the largest benefits, while healthy and mixed samples showed smaller yet meaningful gains. Certain intervention types demonstrated stronger effects; however, these findings were not entirely consistent across all analyses, and several moderator models showed limited statistical power.

Long-term follow-up analyses suggest that improvements in depression tend to be sustained over time, whereas anxiety-related benefits appear less stable over time and more heterogeneous across trials. No clear association was found between intervention duration and symptom change for either outcome.

Taken together, SG-MBIs have meaningful potential for reducing depression and anxiety, particularly in clinical populations and in interventions emphasizing self-compassion. Nonetheless, the presence of high heterogeneity, inconsistent long-term effects, and underpowered moderator analyses underscores the need for future research employing larger samples, standardized protocols, and consistent outcome measures to strengthen the evidence base and inform clinical practice.

4.2. Effects among different groups

Our analysis revealed that participant type significantly moderated intervention effects for both depression and anxiety, with clinical populations showing the largest and most statistically significant improvements. These findings are partly aligned with those of Hofmann et al. (2010), who reported large effect sizes for mindfulness-based interventions in clinical populations, indicating greater improvements in those with more severe symptoms. Healthy adults also experienced statistically significant improvements, though of smaller magnitude. Although the observed effect sizes for healthy populations were comparatively modest, the results nevertheless indicate potential applicability of SG-MBIs beyond clinical settings, possibly serving preventive purposes or promoting emotional resilience in the general population (Zheng et al., 2022).

For depression, clinical participants showed the most pronounced reductions in symptoms,

whereas healthy and mixed samples showed smaller yet meaningful improvements. Importantly, the moderator analysis for depression demonstrated strong statistical power (power RE = 0.8302 at post-intervention, and 0.9999 at follow-up), reinforcing the robustness of these findings. In contrast, anxiety symptoms exhibited a similar pattern, with clinical populations showing the greatest improvements, followed by mixed and healthy groups, all of which achieved statistical significance. However, the statistical power for this moderator analysis was relatively low (power RE = 0.6845), indicating that although the results were significant, they should be interpreted with caution.

Collectively, these findings underscore the considerable benefits SG-MBIs offer to clinical populations experiencing higher baseline depression and anxiety symptom severity. Given this evidence, future research may focus on optimizing SG-MBIs for clinical groups. Additionally, replications using larger samples and more balanced subgroup representation are needed to improve the precision and generalizability of these conclusions.

4.3. Differences across measurement instruments

This meta-analysis included 12 instruments for depression and 15 for anxiety, reflecting substantial variability in outcome measurement across trials. Meta-regression indicated that outcome measure type was not a significant moderator for either depressive or anxiety symptoms, suggesting that differences in effect sizes are unlikely to be explained solely by the choice of measure. However, subgroup analyses revealed notable differences in scale responsiveness. For depression, measures such as the DASS-21 consistently detected significant symptom reductions, whereas others (e.g., CES-D, BDI-II, PHQ-8/9, and HADS-D) showed weaker or non-significant changes. Similarly, for anxiety, the DASS-21 and STAI demonstrated higher sensitivity in capturing improvements, while measures such as GAD-7 and HADS-A yielded smaller effects or lacked statistical significance. These discrepancies likely reflect variations in measurement sensitivity and scoring algorithms rather than true differences in intervention efficacy, consistent with prior findings that certain tools (e.g., DASS-21) classify more individuals above clinical thresholds than others (Peters et al., 2021). Notably, the moderator analyses on outcome measure type had low statistical power, suggesting that nonsignificant results should be interpreted cautiously, as they may reflect limited power rather than the absence of a true effect.

4.4. SG-MBI intervention components

This review included a total of 35 intervention methods, of which only 30 were supported by evidence from a single RCT. Due to variations in meditation forms and instructional content among these interventions, and given that many intervention details were not fully reported, this study conducted a preliminary classification based on available information. The classification primarily focused on the components emphasized in the interventions (self-

compassion, other-compassion, others).

Our subgroup meta-regression analyses indicated that, although all intervention components (self-compassion, other-compassion, and others) were associated with significant symptom improvements for both depression and anxiety, no statistically significant moderation effect emerged to differentiate their effectiveness clearly. Nevertheless, interventions emphasizing self-compassion showed consistently larger effect sizes across both depression and anxiety outcomes. These findings align with previous research highlighting self-compassion as a critical mechanism in alleviating psychological distress and enhancing emotional regulation (Neff & Germer, 2013; Ferrari et al., 2019).

The overall lack of significant moderation suggests that, although variations exist in the core focus of these interventions, no single component emerged as universally superior across all symptom domains. Still, the observed patterns highlight potential differential pathways of SG-MBI effectiveness depending on symptom domain. It is important to note that while modern psychological frameworks often distinguish between self-compassion and compassion for others, traditional Buddhist thought emphasizes their inseparability. Teachings from figures such as Shantideva illustrate that true compassion arises from recognizing the shared nature of suffering and cultivating an all-encompassing concern for both self and others (Crosby & Skilton, 1996; Dalai Lama & Thupten, 1995). This principle is echoed in the Diamond Sūtra (Vajracchedikā Prajñāpāramitā), which articulates the radical non-dual view through the passage: “There is no appearance of a self, no appearance of a person, no appearance of a sentient being, and no appearance of a lifespan**”** (*Diamond Sūtra*, chap. 14; Conze, 1972). Such teachings dismantle the dualistic boundary between self and other, suggesting that compassion naturally flows when the illusion of separateness dissolves. Future interventions might benefit from adopting this integrated perspective to optimize outcomes across mental health domains

Our meta-regression analysis revealed that the type of intervention significantly moderate treatment effects for both depressive and anxiety symptoms, with MSC consistently demonstrating the strongest effects. These findings support the efficacy of MSC as a particularly promising SG-MBI approach, corroborating existing research indicating substantial benefits from cultivating mindful self-compassion in clinical and non-clinical populations (Neff & Germer, 2013; Kirby et al., 2017). However, in the present review we used a no-intercept moderator model to accommodate categories with small sample sizes ($k = 2$), and the pairwise contrasts showed no statistically significant differences among intervention types. Thus, although MSC appeared numerically strongest, this should be interpreted with caution given the small subgroups and limited statistical power. Future studies should replicate and extend these analyses using adequately powered designs to reliably confirm whether specific intervention types confer additional advantages beyond general SG-MBI principles.

4.5. Intervention length and role of meditation practice

The meta-regression analysis did not reveal a significant association between intervention length and symptom reduction for either anxiety or depressive symptoms. This suggests that the duration of the intervention, in isolation, may not be a key determinant of its effectiveness. However, this finding contrasts with a previous meta-analysis by Lv et al. (2020), which found marginally significant associations between intervention length and effects.

In addition to intervention length, several studies also reported on participants' actual meditation practice during the intervention, offering further insight into dose-response relationships and perceived effectiveness.

Among the studies reviewed, 14 independent trials reported data on meditation practice duration. Of these, 13 addressed depression-related variables and 12 addressed anxiety-related variables. Specifically, 6 studies calculated correlations between meditation duration and improvements in depressive symptoms, while 7 did so for anxiety symptoms. An additional 4 studies focused solely on participants' subjective evaluations of the contribution of meditation practice. Collectively, these investigations offer a multifaceted perspective—both quantitative and qualitative—on the role of meditation in interventions for emotional disorders.

In research examining both depressive and anxiety symptoms, Zhou et al. (2021) found that the duration of meditation practice was significantly correlated with improvements in appreciative joy, gratitude, and stress during the first two weeks (p = .048), yet it showed no clear relationship with changes in depression or anxiety (p >.05). Similarly, Koszycki et al. (2016) reported a positive correlation between total meditation time and post-intervention self-compassion (r = 0.56; p = .019), but no significant link to depressive or anxiety symptom improvement. These findings suggest that although SG-MBIs are effective overall, the amount of meditation practice may not directly predict short-term symptom change.

Goldberg et al. (2020) observed that participants whose daily meditation frequency reached or exceeded the median showed more pronounced reductions in both depressive and anxiety symptoms, suggesting that greater intensity or frequency of practice could confer stronger therapeutic benefits. In contrast, Hudson et al. (2020) found no significant association between meditation practice and improvements in depression scores, yet reported a robust negative correlation with anxiety (HADS-A) scores (r = −0.62; p < .05), indicating that longer practice was linked to lower anxiety. Meanwhile, Haukaas et al. (2018) and Liu et al. (2021) did not detect any significant correlations between total practice time and improvements in either depression or anxiety.

One additional study offers insights into potential mechanisms. Wren et al. (2019) reported a significant practice × time interaction in loving-kindness meditation (LKM) for both anxiety (p = .004) and heart rate (p = .03), indicating that continued LKM practice led to gradual

reductions in both anxiety and physiological arousal.

Beyond quantitative assessments, several studies investigated how participants subjectively perceived the contribution of meditation practice. Rojas et al. (2023) reported a high average usefulness rating (8.1 out of 10), with breathing and loving-kindness meditation receiving the most positive feedback, although they did not quantitatively examine how practice frequency or quality affected depressive or anxiety outcomes. Cheng et al. (2024) underscored the importance of daily practice for facilitating self-reflection and integrating mindfulness into everyday routines. Matos et al. (2017) found that 75.4% of participants considered meditation moderately to very helpful, with 83% recalling feelings of compassion during intervention weeks. Similarly, Al-Refae et al. (2021) noted that 84.8% of participants believed meditation contributed to an overall sense of well-being. Although quantitative findings remain somewhat mixed, these subjective reports consistently suggest that most individuals find meditation helpful for emotional regulation and personal growth.

The reviewed studies highlight mixed but generally positive contributions of meditation practice to emotional well-being, particularly regarding depressive and anxiety symptoms. While some studies found a correlation between meditation duration and improvements in emotional well-being, such as stress, self-compassion (Zhou et al., 2021; Koszycki et al., 2016;), the direct relationship with depression and anxiety symptoms was less consistent. Notably, some studies suggested that more frequent or intense meditation practice could lead to more pronounced benefits, especially for anxiety (Goldberg et al., 2020). However, other studies found no significant association between meditation duration and symptom improvement (Haukaas et al., 2018; Liu et al., 2021), indicating the complexity of the relationship between practice and outcomes. Beyond quantitative assessments, subjective reports emphasized the perceived usefulness of meditation, with many participants expressing that meditation was helpful for emotional regulation and personal growth (Rojas et al., 2023; Cheng et al., 2024). These subjective experiences align with the idea that meditation fosters self-reflection and emotional resilience, even if direct correlations with symptom reduction were not always evident. While these findings suggest that meditation may play a valuable role in enhancing emotional well-being, further research is needed to clarify the mechanisms by which it contributes to symptom reduction (Wren et al., 2019).

4.6. Comparative Efficacy of FG- and SG-MBIs Across Symptom Domains

Both first-generation and second-generation mindfulness-based interventions (MBIs) have demonstrated positive effects on mental health outcomes, though they differ in core training objectives and specific therapeutic emphases. First-generation MBIs (e.g., MBSR, MBCT) primarily cultivate present-moment awareness and nonjudgmental observation of thoughts and emotions, targeting stress reduction and emotional regulation. In contrast, second-generation MBIs (e.g., MSC, LKM, CFT) build upon foundational mindfulness skills while integrating

compassion and self-kindness practices. These include structured "compassion meditations" or "self-compassion exercises" aimed at fostering warmth, empathy, and emotional resilience toward oneself and others.

In terms of empirical evidence, first-generation MBIs benefit from a more established research base. For instance, Khoury et al. (2013) conducted a meta-analysis of 209 studies (109 RCTs), showing that first-generation interventions effectively reduce anxiety and depression symptoms in both clinical and nonclinical populations. Second-generation MBIs, though rapidly growing, are relatively recent in origin, and current evidence mainly focuses on adult populations with specific vulnerabilities such as high self-criticism or caregiving stress. Meta-analyses by Kirby et al. (2017) and Ferrari et al. (2019) synthesized 21 and 15 RCTs respectively, providing preliminary support for second-generation MBIs in alleviating depression and emotional distress.

Regarding symptom-specific outcomes, both generations show moderate to large effects in reducing depression. First-generation MBIs generally yield Hedges' g around 0.50–0.60 for depression (Khoury et al., 2013), with larger pre-post effects in clinical populations (SMD = 0.96; Zhang et al., 2022). MBCT also demonstrates significant preventive benefits against depressive relapse and reduces suicidal ideation (SMD = -0.33; Zhang et al., 2022). Second-generation MBIs are similarly effective for depression, particularly in enhancing self-compassion and emotional resilience. Kirby et al. (2017) reported a pooled effect size of d = 0.64. Moreover, CFT appears especially effective for depressive individuals with high self-criticism (Leaviss & Uttley, 2015). It is worth noting, however, that compassion-based interventions often show significant effects compared to waitlist controls but do not consistently outperform active treatments. For example, Petrovic et al. (2024) found significant improvements in mindfulness, compassion, positive affect, and psychological symptoms relative to passive controls, yet no clear advantage over active comparators or alternative evidence-based interventions.

In the treatment of anxiety, first-generation MBIs generally yield moderate effects, with Hedges' g around 0.5, and clinical pre-post effects reaching as high as g = 0.97 (Hofmann et al., 2010). The improvements in anxiety symptoms often persist into follow-up and are comparable to traditional CBT (Khoury et al., 2013). While MBIs show strong outcomes in clinical populations, their efficacy in school-based adolescent settings remains uncertain. For instance, Fulambarkar et al. (2023) reported that MBIs did not significantly outperform active control groups in reducing anxiety among middle school students (Hedges' g = 0.27, p = .08), indicating that the added value of MBIs in real-world educational settings may be limited.

For second-generation MBIs, the effect sizes for anxiety are generally smaller than those for depression. Compassion-based interventions demonstrate small to moderate effects on

anxiety (e.g., d = 0.49; Kirby et al., 2017). Self-compassion training tends to have weaker direct effects on anxiety, and while LKM may improve emotion regulation and reduce negative affect, its benefits typically do not exceed those of active control interventions (Petrovic et al., 2024).

In other domains, each generation has unique advantages. First-generation MBIs are well-supported in reducing perceived stress, improving somatic health, and enhancing adaptation in chronic illness. For example, Fulambarkar et al. (2023) found an average effect size of g = 0.55 for perceived stress, and Chayadi et al. (2022) reported a significant reduction in cancer-related fatigue (g = 0.43). First-generation MBIs also promote higher mindfulness trait scores and improved quality of life. In contrast, second-generation MBIs uniquely enhance positive psychological attributes. Meta-analytic findings show significant improvements in self-compassion and well-being, with effect sizes around 0.5. For example, Kirby et al. (2017) reported that second-generation MBIs significantly enhanced psychological well-being (d = 0.51), reduced psychological distress (d = 0.47), and improved empathy and reduced shame. Nonetheless, applications in trauma, suicide prevention, chronic illness, and caregiving populations remain in early stages and warrant further high-quality research.

In summary, while first-generation MBIs currently dominate in research volume and broad applicability, second-generation MBIs offer distinctive value in cultivating compassion, self-kindness, and positive psychological development. Both approaches are effective for treating depression and anxiety and may serve complementary roles. Future research should further explore their integrative applications and underlying mechanisms.

4.7. Mediators and moderators of intervention effects

This study's meta-regression analysis identified several potential mediators and moderators that influence the effectiveness of mindfulness-based interventions for depression and anxiety. These variables shed light on the mechanisms underlying therapeutic outcomes and highlight the complex and individualized nature of psychological interventions.

4.7.1. Potential mediators

Based on existing literature on interventions targeting anxiety and depression, researchers have identified multiple potential mediators, including mindfulness, psychological flexibility, stagnation, self-compassion, social connectedness, defusion, and rumination. These mediators exhibit varying degrees of effectiveness and mechanisms of action across different studies, playing important predictive and explanatory roles in intervention outcomes. However, inconsistencies also emerge. For instance, in anxiety interventions, some studies report a significant mediating effect of mindfulness (Benn et al., 2012; Goldberg et al., 2020), while others do not find it to reach statistical significance (Liu et al., 2021). Similarly, self-compassion serves as a key mediator for reducing depressive symptoms in some studies (Schuling et al., 2020) but appears non-significant in others (Liu et al., 2021; Benn et al., 2012). These divergent

findings highlight both the commonalities in the underlying mechanisms of anxiety and depression and the differences in how specific interventions take effect.

Among the various potential mediators, mindfulness, psychological flexibility, and stagnation consistently demonstrate importance across both anxiety and depression. Mindfulness has been widely shown to be a crucial mechanism for symptom improvement (Benn et al., 2012; Strangier et al., 2023; Goldberg et al., 2020), given its focus on heightening awareness and acceptance of present-moment experiences, thereby reducing automated thought patterns and emotional reactivity. Psychological flexibility underscores the ability to regulate oneself in the face of stress or negative emotions, allowing individuals to remain guided by personal values rather than being dominated by emotional distress (Montero-Marín et al., 2018). Stagnation—a state of mind-body blockage—has also been emphasized as an important mediator in both anxiety and depression interventions (Lo et al., 2013). Furthermore, Haukaas et al. (2018) reported that both the intervention group and an active control group showed significant improvements in mindfulness, self-compassion, and attention flexibility from pre- to post-intervention, yet attention flexibility emerged as the only significant predictor variable.

Although mindfulness and psychological flexibility appear to function as consistent mediators for both anxiety and depression, some studies report variations tied to specific symptoms or research designs. For example, Liu et al. (2021) found that mindfulness, self-compassion, and mindful parenting were not significant mediators in anxiety reduction, whereas Benn et al. (2012) showed that mindfulness significantly mediated anxiety improvement, while self-compassion did not. In the domain of depression, Schuling et al. (2020) identified self-compassion as a significant mediator of symptom improvement, whereas variables such as mindfulness and brooding did not reach significance. Conversely, Liu et al. (2021) indicated that mindfulness can be an important mediator for depression. These discrepancies may stem from differences in population characteristics or intervention modalities, underscoring the importance of tailoring research and clinical interventions to specific individual and contextual factors. Garrote-Caparrós et al. (2023) proposed that the improvement in psychotherapists' mindfulness skills serves as a key mediating mechanism for enhancing empathy, with a significant association observed between increased mindfulness skills (e.g., "being present" and "instruction") and enhanced empathy. However, while enhanced empathy contributes to the improvement of patients' symptoms (such as depression, anxiety), this relationship did not reach statistical significance, though it may hold potential clinical relevance.

4.7.2. Potential moderators

A substantial body of research indicates that the effectiveness of interventions for depression and anxiety is influenced not only by the intervention techniques and formats employed but also by individual differences, baseline psychological characteristics, and

lifestyle factors. As studies have evolved, variables such as age, personality traits (e.g., agreeableness, level of self-compassion), cognitive factors (e.g., rumination, fear of self-compassion), and engagement in spiritual or mind-body practices have been increasingly recognized as potential moderators of treatment outcomes. In the realm of depression interventions, baseline levels of compassion or self-compassion, childhood trauma, and personality traits (e.g., agreeableness) have shown significant moderating effects (Schuling et al., 2020; Mongrain et al., 2018; Strangier et al., 2023; Goldberg et al., 2020; Yeshua & Zohar, 2024; Bringmann et al., 2024). Meanwhile, in anxiety interventions, factors such as baseline anxiety, fear of self-compassion, and levels of rumination, empathy, and defusion may also moderate treatment efficacy (Soo et al., 2016; Teale Sapach & Carleton, 2023; Goldberg et al., 2020). Overall, these studies collectively suggest that psychological interventions cannot be reduced to a universal approach. Instead, they must consider individual and contextual differences to develop more targeted treatment strategies.

In depression interventions, researchers have identified multiple moderating factors. First, Schuling et al. (2020) emphasized age and age of onset, finding that younger individuals or those experiencing depression at an earlier stage generally respond better to treatment, while childhood trauma did not show a significant moderating effect. In addition, baseline levels of compassion or self-compassion can predict symptom improvement during certain phases of therapy (Strangier et al., 2023), though these effects may not be significant in early treatment stages or overall outcomes. Furthermore, Mongrain et al. (2018) reported that individuals with lower agreeableness benefit more from Acts of Kindness interventions, demonstrating both greater reduction in depressive symptoms and increased life satisfaction over a two-month follow-up period—a finding that underlines the importance of personality traits in moderating treatment effects. Goldberg et al. (2020) similarly noted that higher baseline levels of rumination, empathy, and defusion were associated with more pronounced treatment gains. Extending these insights, Yeshua and Zohar (2024) proposed that self-compassion meditation (SCFM) could especially benefit those with low self-compassion and introjective tendencies, who often experience intense guilt and harsh self-criticism. Targeted self-compassion training may significantly alleviate symptoms and lower suicide risk in this population. Lastly, Bringmann et al. (2024) identified that baseline engagement in spiritual or mind-body practices (e.g., religious or meditative activities) moderated the long-term effects of treatment: individuals with lower initial engagement saw greater benefit, whereas those who regularly engaged in such practices showed no significant differences.

Similarly, anxiety intervention research has explored a wide range of moderating factors. Soo et al. (2016) investigated patient and radiologist characteristics (including demographic factors, pre-biopsy anxiety, biopsy type, and radiologist training background), but none significantly moderated the impact of the intervention on anxiety, pain, or fatigue. In contrast, Teale Sapach

and Carleton (2023) examined the "fear of self-compassion" and found that although it did not significantly moderate the relationship between treatment and outcome variables, it had a notable main effect on social anxiety disorder (SAD) symptoms and self-compassion levels: individuals with a higher fear of self-compassion may enter treatment with heightened hesitancy and self-doubt, thereby reducing the likelihood of reaping full therapeutic benefits. Similarly, Goldberg et al. (2020) observed that individuals with higher baseline levels of rumination, empathy, and defusion tended to achieve better treatment outcomes in anxiety interventions, suggesting that one's initial mindset and coping style play critical roles in shaping responsiveness. Notably, we drew on two recent studies that were not included in our quantitative synthesis—Yeshua & Zohar (2024) and Bringmann et al. (2024)—to enrich the exploration of potential moderators.

4.8. Buddhist Roots and the Rise of Second-Generation MBIs

Mindfulness-based interventions (MBIs) trace their roots to Buddhist contemplative traditions, particularly Theravāda insight meditation, Japanese/Chinese Zen, and Tibetan Mahāmudrā and Dzogchen lineages. When adapted into contemporary clinical settings, these practices underwent significant de-contextualization: first-generation MBIs (FG-MBIs)—such as Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT)—were deliberately stripped of explicit religious and ethical frameworks to ensure cultural neutrality and clinical scalability (Kabat-Zinn, 1990). Their primary objectives became stress reduction and symptom alleviation, while foundational elements of Buddhist ethics and wisdom were largely excluded

Despite this secular adaptation, MBIs as a whole—both FG-MBIs and SG-MBIs—retain essential meditative principles from non-dual Buddhist traditions, these implicit foundations are seldom made explicit in intervention protocols. Three dimensions are particularly salient:

First, nonjudgmental awareness of the present moment, as emphasized in classical texts such as the *Platform Sūtra* ("Originally nothing is there—whence can dust alight?"[1]) and echoed in Mahāmudrā instructions that prohibit labeling experience as "good" or "bad." This principle underlies the frequent MBI guidance to observe thoughts, emotions, and bodily sensations as they arise, without evaluation or suppression.

Second, the practice of letting be, or non-interference, rooted in Nāgārjuna's doctrine of dependent co-arising and *śūnyatā* (emptiness), as well as Dzogchen's notion of *rang-bab* ("self-release" or "spontaneous presence"). Rather than striving to control inner states—such as forcing the breath or eliminating anxiety—modern MBIs encourage allowing experiences to

[1] This is a translation of the Chinese verse "本来无一物，何处惹尘埃," traditionally attributed to the Sixth Patriarch Huineng (638–713) in *The Platform Sūtra of the Sixth Patriarch*. The verse is often cited as an expression of the Chan (Zen) Buddhist doctrine of inherent purity and non-attachment

unfold and dissolve naturally, fostering a more fluid and less effortful relationship with internal phenomena.

Third, reflexive awareness (*svasamvitti*), drawn from Yogācāra epistemology and the *Abhidharma-kośa*, which denotes the mind's intrinsic capacity to know that it is knowing. In practice, participants are guided to recognize awareness itself, thereby softening the habitual dualism between observer and observed and cultivating a metacognitive presence consistent with non-dual phenomenology.

These principles form the contemplative bedrock upon which mindfulness interventions were originally constructed. While FG-MBIs distilled these elements primarily into attentional training for secular healthcare, SG-MBIs extend this foundation by explicitly reintegrating ethical and compassion-based dimensions. Specifically, SG-MBIs seek to counterbalance the value-neutral stance of first-generation programs by embedding ethical and wisdom components—most notably through the cultivation of the Four Immeasurables (mettā, karuṇā, muditā, upekkhā). Drawing on canonical sources such as the *Mettā Sutta* and the *Catu-brahmavihāra* passages of the Āgamas/Nikāyas, SG-MBIs incorporate loving-kindness and compassion meditation, structured reflective exercises, and other practices designed to restore prosocial motivation and moral sensitivity (Van Gordon et al., 2015; Lv et al., 2020). Consistent with this trend, our meta-analysis focuses primarily on interventions grounded in the ethical dimension—specifically those designed to cultivate compassion (whether toward self or others) and loving-kindness.

Unlike FG-MBIs, which adopt a value-neutral stance, SG-MBIs incorporate Buddhist-inspired "soft ethics" without imposing rigid doctrinal commitments. These programs often draw upon the Buddhist *triśikṣā* ("three trainings")—ethics (*sīla*), concentration (*samādhi*), and wisdom (*prajñā*)—as a guiding framework for curriculum design (Anālayo, 2017; Furnell et al., 2024b). Within this structure, ethics emphasizes the cultivation of compassion, altruistic intentions, and prosocial behaviors; concentration involves meditative stabilization and mindfulness practice; and wisdom highlights deeper insight into impermanence, interdependence, and emptiness. In practice, however, most SG-MBIs currently focus primarily on cultivating ethics (*sīla*), while wisdom-based practices remain relatively rare due to their conceptual and experiential complexity.

To date, only one empirical study has directly incorporated an emptiness-based meditation component (Van Gordon et al., 2019). This trial found that, compared with mindfulness meditation, the emptiness meditation group showed significantly greater increases in the desire to help strangers—a result attributed to the "compassionate vision" fostered by an experience of non-dual awareness, which enhances both compassion and altruistic motivation. However, such practices are considered advanced and may be difficult to implement for beginners or

intermediate practitioners without appropriate preparatory training (Furnell et al., 2024b). This limitation underscores an important direction for future development.

Second-generation MBIs (SG-MBIs) deliberately reverse part of that secularisation by reintegrating core Buddhist ethics—most visibly the *Four Immeasurables* (*mettā*, *karuṇā*, *muditā*, *upekkhā*). Classic sources such as the Mettā Sutta and the *Catubrahmavihāra* passages of the Āgamas/Nikāyas provide the textual basis for cultivating loving-kindness, compassion, appreciative joy, and equanimity. Contemporary programmes—e.g., Loving-Kindness Meditation, Compassion-Focused Therapy, Cognitively-Based Compassion Training—embed these practices through silent phrases and imaginal targets, thereby re-establishing prosocial motivation and ethical sensitivity that FG-MBIs left implicit (Lv et al., 2020; Van Gordon et al., 2015).

This ethical-phenomenological shift differentiates SG-MBIs from both FG-MBIs and classical Theravāda frameworks. In the latter, moral discipline (*śīla*) and evaluative discernment between wholesome and unwholesome states are prerequisites for concentration and insight (Bodhi, 2013). By contrast, FG-MBIs purposefully adopt a value-neutral stance to fit secular healthcare. SG-MBIs chart a middle course: they do not impose monastic precepts, yet they explicitly cultivate *karuṇā* and *mettā* as "soft ethics," thereby aligning practice with Buddhism's foundational concern for the welfare of self and others (Shonin et al., 2015; Chen & Jordan, 2020).

This re-anchoring has several implications. First, integration of the Four Immeasurables appears to boost social connectedness and perceived safety, mechanisms linked to anxiety reduction (Kirby et al., 2017). Second, embedding compassion may counterbalance the instrumental "technique-ification" sometimes levelled at FG-MBIs by restoring an orientation toward altruistic motivation.

Still, important divergences remain. While non-dual traditions require rigorous between-session ethical commitments (bodhicitta, precepts, generosity), SG-MBIs typically rely on implicit value formation rather than formal vows; their ultimate goal is psychological well-being, not liberation from saṃsāra. Accordingly, future intervention research could profit from marrying Buddhist long-range aims with positive-psychology constructs, testing whether explicit compassion cultivation produces additive benefits over mindfulness-alone formats, and using neurophenomenology to examine how reflexive awareness interfaces with prosocial neural circuitry.

In summary, SG-MBIs represent a move back toward Buddhism's ethical and compassionate roots while forward into empirically testable clinical science. By fusing non-dual phenomenological techniques with the Four Immeasurables, they offer a richer, more holistic avenue for mental-health promotion than the strictly symptom-focused first-generation

programmes.

4.9. Controversies on the Definition, Operationalization, and Ethical Foundations of SG-MBIs

As mindfulness-based interventions (MBIs) evolve, second-generation MBIs (SG-MBIs) have emerged as an integrative response aiming to re-anchor contemporary mindfulness in its Buddhist ethical and philosophical foundations. However, the definition and operationalization of SG-MBIs remain contested within both theoretical and empirical discourse.

First, there is no consensus on the essential features that constitute an SG-MBI. Some scholars argue that SG-MBIs must explicitly integrate Buddhist ethics—such as non-harming (ahiṃsā), compassion (karuṇā), and the bodhisattva ideal—into the curriculum (Van Gordon et al., 2015). From this view, mindfulness is not merely attentional training but a psycho-spiritual mode of being grounded in discernment and moral responsibility. Typical SG-MBIs may include contemplative practices based on the four immeasurables (brahmavihārās), combined with reflections on Buddhist concepts like non-self (anātman), interdependence (pratītyasamutpāda), and emptiness (śūnyatā), aiming at more holistic transformation (Zhou et al., 2024).

Conversely, many developers of first-generation MBIs (FG-MBIs), such as MBSR or MBCT, adopt a secular, medicalized framework and advocate for minimal religious or doctrinal influence (Kabat-Zinn, 2011). From this perspective, ethics are seen as emergent properties of mindfulness practice and not components to be formally taught. Critics warn that overt integration of Buddhist ethics may lead to cultural inaccessibility, potential dogmatism, or reduction of scientific credibility. Some have further argued that emphasizing Buddhist orthodoxy may risk recreating a new form of "mindfulness essentialism," akin to the very "McMindfulness" trend it criticizes (Purser & Loy, 2013).

Operational disagreements also persist. Some interventions are labeled as SG-MBIs merely by adding compassion or loving-kindness meditation to an MBSR framework. Other researchers insist that an SG-MBI must fundamentally revise its curriculum structure, ethical scaffolding, and instructor training in accordance with Buddhist soteriological aims (Van Gordon et al., 2015). This ambiguity leads to inconsistencies in labeling across studies, undermining the comparability and replicability of SG-MBI research (Monteiro et al., 2015).

To address these challenges, some have proposed reframing MBIs through the traditional Buddhist "three trainings" (triśikṣā) structure: ethics (śīla), concentration (samādhi), and wisdom (prajñā) (Anālayo, 2017; Furnell et al., 2024a, 2024b). In this model, MBIs can be classified according to their functional emphasis as "Calmer" (attention/concentration-focused), "Kinder" (ethics/compassion-focused), and "Wiser" (insight-oriented) programs (Furnell et al., 2024a, 2024b). This typology not only clarifies the theoretical intentions of each MBI variant

but also highlights the depth of ethical and transformative aims embedded in second-generation approaches. In our meta-analysis, we adopt this view and emphasize that the "ethical" component does not refer to strict Buddhist precepts but to a broader cultivation of loving-kindness and compassion—toward both self and others—as the moral bedrock of SG-MBIs.

Empirical validation of SG-MBIs, however, remains a developing endeavor. While early studies were largely concept-driven, recent randomized trials have demonstrated superior outcomes of SG-MBIs over FG-MBIs in enhancing self-compassion, prosociality, and psychological well-being (Chen & Jordan, 2020). Still, most samples are drawn from healthy or subclinical populations, limiting generalizability to clinical contexts. Longitudinal, cross-cultural evaluations remain sparse.

Despite ongoing debate, a tentative convergence is emerging. Williams and Kabat-Zinn (2011) acknowledged that ethical considerations are unavoidable, especially as the field grapples with cases of adverse effects and misuse of mindfulness (Britton et al., 2021). This suggests a future where mindfulness interventions diversify further: FG-MBIs may retain a streamlined, secular format for clinical utility, while SG-MBIs explore deeper ethical and philosophical integration for personal growth, education, and community well-being. To support this evolution, greater efforts are needed to standardize SG-MBI definitions, ensure quality in ethics training, and foster cultural adaptability (Van Gordon et al., 2015).

In sum, the debate over SG-MBIs reflects a broader tension between mindfulness as a clinical tool and mindfulness as a path of inner cultivation. By clarifying the definitional and structural boundaries of SG-MBIs, researchers can promote transparency, cultural relevance, and ethical integrity, ultimately contributing to a more comprehensive model of human flourishing. Future research should prioritize the development of consensus-based frameworks that classify MBIs according to core elements such as ethical foundations, compassion practices, and cognitive/insight components to improve consistency and replicability in the field.

4.10. Clinical Implications

The present findings offer several important insights into the clinical applicability of SG-MBIs for depression and anxiety. Our moderator analyses revealed two clinically relevant findings. First, SG-MBIs yielded substantially greater effects in clinical populations than in healthy or mixed samples—roughly 2–3 times larger symptom reductions, as reflected by higher Hedges' g values. Second, trials that explicitly identified depression or anxiety as the primary outcome demonstrated stronger effects than those treating them as secondary outcomes. These results suggest that SG-MBIs are most effective when used as targeted interventions for clearly defined clinical issues, rather than broad wellness programs. This aligns with prior research showing mindfulness-based therapies are particularly effective for anxiety and depression in clinical settings (Hofmann et al., 2010).

These findings have implications for trial design and resource allocation. Predefining a single primary outcome enhances statistical power and interpretability, reducing the risk of false positives. Likewise, recruiting participants with clinically elevated symptoms—rather than low-symptom or heterogeneous samples—can maximize observable effects. In short, the clinical utility of SG-MBIs is clearest when interventions are precisely targeted toward those who need them most.

The Number Needed to Treat (NNT) provides an intuitive indicator of clinical impact, with lower values reflecting greater treatment effectiveness. However, NNTs derived from different clinical contexts are not directly comparable due to variations in outcomes, interventions, and follow-up periods (Cordell, 1999). In this study, we interpreted the clinical relevance of NNTs with reference to a commonly cited benchmark range, in which an NNT between 2 and 5 is typically considered indicative of an effective therapy (Barratt, 2009).

Overall, the NNTs for immediate effects were close to this reference range, with values of 5.3 for depression and 5.1 for anxiety. Subgroup analyses indicated more favorable outcomes in clinical populations (NNT = 2.3 and 2.2), in trials pre-specified depression or anxiety as the primary outcome (NNT = 4.8 and 4.4), and for interventions such as Mindful Self-Compassion (NNT = 2.5 for depression; 2.1 for anxiety). Conversely, higher NNTs in healthy samples and non-primary outcome studies (≥7.7) suggest more limited clinical gains in low-symptom groups or exploratory designs.

Follow-up analyses provided further insight: the pooled NNT at follow-up for depression was 4.4 (g = 0.70), still indicating strong clinical impact, while the follow-up NNT for anxiety was 10.0 (g = 0.34), reflecting a smaller and non-significant long-term effect. These findings highlight the value of targeting SG-MBIs toward high-need populations, ensuring clear intervention goals, and maintaining measurement consistency to maximize real-world impact.

5. Limitations

Although this meta-analysis provides valuable insights into the effectiveness of second-generation mindfulness-based interventions (SG-MBIs) for reducing depression and anxiety symptoms, several limitations should be considered.

First, the risk of bias across included studies was variable. Most trials were rated as having “some concerns,” primarily related to outcome measurement and selective reporting, and three were judged as high risk. Although sensitivity analyses excluding high-risk studies produced similar results, this variability may influence the certainty of effect estimates. Additionally, follow-up data were limited, and many trials had small sample sizes, which could reduce statistical power and generalizability.

Second, heterogeneity was observed across interventions, outcome measures, and intervention reporting. Although subgroup and meta-regression analyses were conducted to explore potential moderators, non-significant findings may reflect insufficient statistical power—partly due to small sample sizes and the limited number of studies per subgroup—rather than the absence of true effects. The distribution-based approach to estimating minimal important differences (MIDs) also has inherent limitations, including the lack of anchor-based validation. Notably, the small number of studies within each subgroup further constrained the ability to detect true moderator effects. Additionally, the possibility of publication bias cannot be fully ruled out and should be considered in interpreting the findings.

Additionally, two studies (Kemeny et al., 2012; Gentile et al., 2020) were excluded because they reported only F-values without means and standard deviations. Although formulas are available to convert F-values and sample sizes into standardized mean differences, such conversions require design-specific assumptions that may not hold across studies (e.g., mixed or repeated-measures ANOVAs). Following the methodology of the meta-analysis by Zainal et al. (2024), to maintain consistency and transparency in effect size estimation, we therefore included only studies reporting sufficient descriptive statistics. Given that only two trials were affected and both showed effects in a similar direction, this decision is unlikely to have materially influenced the meta-analytic conclusions.

Finally, while the SG-MBIs included in this meta-analysis primarily integrated ethical and compassion-based practices, none explicitly incorporated wisdom-oriented components (e.g., emptiness meditation), which represent a theoretically important yet empirically underexplored dimension of second-generation interventions. Although this review focused primarily on intrapersonal ethical practices, we acknowledge that three included studies involved interpersonal dimensions (e.g., mindful parenting, mindfulness interventions targeting parents or educators). However, it is important to clarify that these studies were not included based on an “interpersonal mindfulness” criterion; rather, they were included because they met our other predefined eligibility criteria for SG-MBIs. Specifically, Liu et al. (2021) included compassion-based practices (loving-kindness, self-compassion) and ethical reflections; Benn et al. (2012) incorporated compassion and kindness practices, forgiveness, and ethical components beyond attentional training; and Lo et al. (2017) integrated mindfulness with compassion-based elements and ethical reflection. Given the limited number of such interventions and the fact that “interpersonal mindfulness” was not explicitly part of our initial operationalization, these studies were not systematically examined or analyzed separately. Future research should explicitly investigate whether systematically incorporating wisdom-based practices and interpersonal components—central to the contemplative roots of SG-MBIs—can confer additional benefits for clinical outcomes and overall well-being.

This review did not fully adhere to the initial PROSPERO registration; details of

deviations, along with the PRISMA checklist, are provided in Supplement S1 to ensure methodological transparency. A separate review protocol was not prepared beyond the PROSPERO registration.

6. Conclusion

In conclusion, this meta-analysis found that SG-MBIs significantly reduced depressive (Hedges' g = 0.59) and anxiety symptoms (Hedges' g = 0.61). However, sensitivity and bias analyses call for cautious interpretation: Trim-and-Fill suggested missing studies, and outlier removal markedly reduced effects (depression: g = 0.44; anxiety: g = 0.40), though significance was retained. Excluding high-risk-of-bias studies produced similar results (depression: g = 0.61; anxiety: g = 0.64), indicating overall robustness despite methodological limitations.

Moderator analyses revealed that participant type significantly influenced outcomes, with clinical populations showing the greatest improvements. Intervention type also moderated effects, with self-compassion–focused programs (e.g., MSC) appearing most effective. Other variables, including intervention components, outcome measures, primary outcome status, risk of bias status, and duration, did not moderate treatment effects. However, most moderator analyses were underpowered, and the findings should therefore be interpreted with caution.

Follow-up data indicated sustained depression improvements but inconsistent durability for anxiety. To advance the field, future studies should aim for greater standardization in defining and operationalizing SG-MBIs, explicitly incorporating ethical and compassion-based practices aligned with their contemplative roots. Additionally, exploring wisdom-based practices—such as meditation on emptiness—and interpersonal mindfulness components could enrich the understanding of SG-MBI mechanisms and broaden their therapeutic potential. Finally, adequately powered randomized controlled trials with standardized, clinically meaningful outcome measures are essential to strengthen the precision, interpretability, and clinical applicability of future research findings.

PRISMA compliance

This systematic review and meta-analysis followed the PRISMA 2020 guidelines (Page et al., 2021). The completed PRISMA checklist is provided in the supplementary materials (Supplementary S1).

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Competing interests

The authors declare that they have no competing interests.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request. Supplementary materials relevant to the study are provided in Supplement S1 and Supplement S2.

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Table 1: Characteristics and Results of Included Randomized Controlled Trials

No.	Author(s)	Sample	Participants	Participant Type (Depression)	Participant Type (Anxiety)	Type of Intervention	Duration and Frequency	Outcome variables
1	Aguilar-Raab et al., 2023	N = 49 couples (CBCT-fC group: n = 27; TAU group: n = 22); Mage = 42.96 years; SD = 14; 100% female	Adults with depression diagnosed using DSM-5 criteria and HDRS score ≥12	Adults Clinical	-	Cognitively-Based Compassion Training for couples (CBCT-fC)	10 weeks, weekly sessions	Depression
2	Lo et al., 2013	N = 165 parents (intervention group: n =83; WL group: n = 82); Mage = 38.87 years; SD = 5.92; 93.9% female	Adults with BDI-II ≥15 or HADS-Anxiety ≥8	Adults Clinical	Adults Clinical	Compassion-Mindfulness Therapy (C-MT)	6 weeks; weekly sessions	Depression
3	Rojas et al., 2023	N = 44 medical students (CCT group: n = 22; WL group: n = 22); Mage = 23.4 years; SD = 5.59; 92.5% female	Medical students without clinical diagnoses; baseline DASS-21 Depression: Intervention M = 4.72, Control M = 4.59; Anxiety: Intervention M = 5.33, Control M = 3.95.	Adults Healthy	Adults Healthy	Compassion Cultivation Training (CCT)	8 weeks; weekly sessions, daily home practice	Depression &Anxiety
4	Cheng et al., 2024	N = 28 (MBI group: n = 14; RT group: n = 14); Mage = 55.21 years; SD = 10.39; 89.3% female	Adults with mental illnesses diagnosed by DSM-5	Adults Clinical	Adults Clinical	REMIND 2.0 (Tailored Mindfulness-Based Intervention)	8 weeks; weekly sessions	Depression &Anxiety
5	Haukaas et al., 2018	N = 81 students (MSC group: n = 41; ATT group: n = 40); Mage = 22.9 years; SD = 3.3; 75.3% female	Students self-reported symptoms of depression, anxiety, or stress without diagnostic interviews.	Adults Mixed	Adults Mixed	Mindful Self-Compassion (MSC)	3 weeks; weekly sessions	Depression &Anxiety
6	Zhou et al., 2021	N =138 Chinese adults (MBPP group: n = 69; WL group: n = 69); Mage = 27.29 years; SD = 8.13; 80.43% females	Chinese university students, staff, and community adults without clinical diagnoses; baseline DASS-21 Depression: Intervention M = 1.69, Control M = 1.75; Anxiety: Intervention M = 1.73, Control M = 1.68.	Adults Healthy	Adults Healthy	Mindfulness-based positive psychology (MBPP)	6 weeks; weekly sessions	Depression &Anxiety
7	Pagliaro et al., 2016	N = 103 cancer patients (TAU: n = 52; control group: n = 51); Mage = 57.09 years; SD = 9.46; 93.2% female	Cancer patients undergoing treatment and deemed psychologically stable; baseline POMS Depression: Intervention M = 55.93, Control M = 51.06; Anxiety: Intervention M = 56.59, Control M = 53.08.	Adults Mixed	Adults Mixed	Tong Len meditation	12 weeks; daily sessions	Depression &Anxiety
8	Al-Refae et al., 2021	N = 165 adults (intervention group: n = 78; WL control: n = 87); Mage = 25.24 years; SD = 8.13; 78.8% female	Adults recruited through social media and mental health organizations.	Adults Mixed	Adults Mixed	A Self-Compassion and Mindfulness-Based Cognitive Mobile Intervention (Serene)	4 weeks; daily sessions	Depression &Anxiety

(Continued from Table 1)

No.	Author(s)	Sample	Participants	Participant Type (Depression)	Participant Type (Anxiety)	Type of Intervention	Duration and Frequency	Outcome variables
9	Shahar et al., 2015	N = 38 participants (LKM group: n = 19; WL group: n = 19); Mage = 30.62 years; SD = 10.57; 60.53% female	Adults with high self-criticism (DAS-SCP ⩾ 30); DASS-21 Depression: Int. M = 4.93, Ctrl. M = 4.28; Anxiety: Int. M = 2.00, Ctrl. M = 1.94.	Adults Healthy	Adults Healthy	Loving-Kindness Meditation (LKM)	7 weeks; weekly sessions	Depression &Anxiety
10	Mongrain et al., 2018	N = 196 participants (LKM: n = 71; Acts of Kindness: n = 64; Control: n = 61); Mage = 32.25 years; SD = 13.75; 67.1% female	Adults recruited online; baseline CES-D: Int. M = 19.00, Ctrl. M = 21.52.	Adults Mixed	-	Loving-Kindness Meditation (LKM)	3 weeks; 12 sessions every other day	Depression
11	Liu et al., 2021	N= 113 Chinese parents of children with ADHD (MPP group: n = 58; WL-control group: n = 55); Mage = 39.79 years; SD = 4.68; 90.27% female	Parents of children with ADHD and elevated parenting stress; baseline HAMA Anxiety: Int. M = 8.52, Ctrl. M = 10.18; HAMD Depression: Int. M = 8.83, Ctrl. M = 10.44.	Adults Mixed	Adults Mixed	Mindful Parenting Program (MPP)	8 weeks; weekly sessions, daily home practice	Depression &Anxiety
12	Asano et al., 2022	N = 17 adults with treatment-resistant depression (CFT group: n = 10; control: n = 7); Mage = 39.88 years; SD = 10.96; 88% female	Adults diagnosed with MDD/dysthymia (DSM-IV), BDI-II ≥20, SSRI treatment-resistant	Adults Clinical	-	Group compassion-focused therapy (CFT)	12 weeks; weekly sessions	Depression
13	Aizik-Reebs et al., 2021	N = 158 Eritrean asylum-seekers (MBTR-R group: n = 98; wait-list control group: n = 60); Mage = 31.8 years; SD = 5.21; 46.2% female	Eritrean asylum seekers with severe trauma histories and chronic post-migration stress, with high baseline PHQ-9 scores (M ≥15),	Adults Clinical	Adults Clinical	Mindfulness-Based Trauma Recovery for Refugees (MBTR-R)	9 weeks; weekly sessions	Depression &Anxiety
14	Mantzios et al., 2019	N = 80 university students (LKM group: n = 40; MM group: n = 40); Mage = 22.48 years; SD = 5.81; 82.5% female	UK university students without clinical diagnoses; baseline SAI Anxiety: Int. M = 11.30, Ctrl. M = 11.78.	-	Adults Healthy	Loving-Kindness Meditation (LKM)	a single 12-minute session	Anxiety
15	Lang et al., 2020	N = 28 veterans (CM group: n = 14; VC group: n = 14); Mage = 49.1 years; SD = 14.5; 25% female	Adults diagnosed with PTSD based on MINI; high baseline depressive/anxiety symptoms (e.g., BSI-18 scores > 64); comorbid depressive/anxiety/substance use disorders permitted	Adults Clinical	Adults Clinical	Cognitively-Based Compassion Training for Vet (CBCT-Vet)	10 weeks; weekly sessions	Depression &Anxiety
16	Hudson et al., 2020	N = 176 (CFT self-help group: n = 85; WL group: n = 91); Mage = 33.81 years; SD = 12.84; 85.8% female	Adults with dermatological conditions and skin-related psychological distress; baseline HADS Depression: Int. M = 6.94, Ctrl. M = 6.52; Anxiety: Int. M = 10.80, Ctrl. M = 10.27.	Adults Mixed	Adults Mixed	Compassion-focused self-help (CFT)	2 weeks; daily practice	Depression &Anxiety

No.	Author(s)	Sample	Participants	Participant Type (Depression)	Participant Type (Anxiety)	Type of Intervention	Duration and Frequency	Outcome variables
17	Bolognino et al., 2023	N = 52 college undergraduates (MBM group: n = 13, LKM group: n = 14, MBM+LKM group: n = 11, RL group: n = 14); Mage = 20 years; SD = 1; 75% female	Undergraduate psychology students without clinical diagnoses; baseline CES-D: Int. M = 18.79, Ctrl. M = 17.79; GAD-7: Int. M = 10.64, Ctrl. M = 9.57.	Adults Mixed	Adults Mixed	Loving-Kindness Meditation (LKM)	2 weeks; 10 minutes per day	Depression &Anxiety
18	Dundas et al., 2017	N = 158 adults (intervention group: n = 53; WL control: n = 64); Mage = 25 years; SD = 4.9; 85% female	University students without clinical diagnoses; baseline MDI: Int. M = 27.6, Ctrl. M = 27.4; STAI: Int. M = 51.2, Ctrl. M = 49.8.	Adults Mixed	Adults Mixed	Mindful Self-Compassion (MSC)	2 weeks; Three sessions	Depression &Anxiety
19	Hansen et al., 2021	N = 161 caregivers (CCT group: n = 79; WL control: n = 82; Mage = 52.6 years; SD = 12.5; 88.2% female	Informal adult caregivers without clinical diagnoses; baseline DASS-21 Depression: Int. M = 10.89, Ctrl. M = 10.80; Anxiety: Int. M = 6.89, Ctrl. M = 6.68.	Adults Mixed	Adults Mixed	Compassion cultivation training (CCT)	8 weeks; weekly sessions	Depression &Anxiety
20	Sahraian et al, 2024	N = 50 (MSC group: n = 25; TAU control: n = 25); Mage = 34.04 years; SD = 6,54; 100% female	Infertile women undergoing IVF without psychiatric diagnoses; SCL-90-R Depression: Int. M = 46.54, Ctrl. M = 47.19; Anxiety: Int. M = 13.9, Ctrl. M = 12.2.	Adults Mixed	Adults Mixed	Mindful Self-Compassion (MSC)	8 weeks; weekly sessions, half-day retreat	Depression &Anxiety
21	Garrote-Caparrós et al, 2023	N = 121 patients (MC group: n=57; ED group: n=64); Mage = 35.7 years; SD = 11.2; 80.1% female	Adults in psychotherapy; ~46% self-reported diagnosis (anxiety, mood, or mixed disorders)	Adults Mixed	Adults Mixed	Mindfulness and Compassion-Based Intervention (MCBI)	8 weeks; weekly sessions	Depression &Anxiety
22	Rubin et al., 2024	N = 91 adults (MC group: n=30; MO group: n=31; WL group: n=30); Mage = 27.32 years; SD = 11.99; 60.44% female	Adults isolating due to COVID-19 without clinical diagnoses; baseline PHQ-8: Int. M = 10.3, Ctrl. M = 8.07; GAD-7: Int. M = 8.1, Ctrl. M = 7.28.	Adults Mixed	Adults Mixed	Mindfulness and Compassion (MC)	single one-hour session	Depression &Anxiety
23	Montero-Marín et al., 2018	N = 42 patients (ABCT group: n=23; Relaxation group: n=19); Mage = 51.45 years; SD = 7.53; 100% female	Adults with fibromyalgia, no depression/anxiety diagnosis or screening, baseline (HADS-A = 13.95, 11.53; HADS-D = 10.35, 8.33)	Adults Mixed	Adults Mixed	Attachment-based compassion therapy (ABCT)	8 weeks; weekly sessions, daily homework	Depression &Anxiety
24	Slivjak et al., 2022	N = 63 adults (Common humanity group: n=32; Exposure only group: n=31); Mage = 19.43 years; SD = 2.25; 68% female	Undergraduates with elevated social anxiety symptoms based on SPIN and LSAS-SR scores; no current depression (PHQ-8 < 10).	-	Adults Mixed	Common humanity-enhanced exposure	Single session	Anxiety

(Continued from Table 1)

No.	Author(s)	Sample	Participants	Participant Type (Depression)	Participant Type (Anxiety)	Type of Intervention	Duration and Frequency	Outcome variables
25	Beshai et al., 2020	N = 456 adults (Mind-OP group: n=227; Active control group: n=229); Mage = 35.13 years; SD = 10.57; 43.9% female	Adults recruited via TurkPrime with PHQ-9 ≥ 8, GAD-7 ≥ 8, and/or PSS ≥ 14; no formal clinical diagnosis.	Adults Mixed	Adults Mixed	Mindfulness and self-compassion online program (Mind-OP)	4 weeks; weekly modules	Depression &Anxiety
26	Soo et al., 2016	N = 121 adults (LKM group: n = 41; Music Attention Control: n = 40; Standard-care control: n = 40); Mage = 53.01 years; SD = 13.21; 100% female	Women undergoing image-guided core-needle breast biopsy, without clinical diagnoses, showing moderate anxiety at baseline (STAI = 44.6, 42.5)	-	Adults Mixed	Loving-Kindness Meditation (LKM)	1-hour session during CNBB	Anxiety
27	Friis et al., 2016	N = 63 adults (MSC group: n = 32; WL group: n = 31); Mage = 44.37 years; SD = 15.62; 68.25% female	Adults with type 1 or 2 diabetes and elevated depressive symptoms; baseline PHQ-9: Int. M = 14.01, Ctrl. M = 9.74.	Adults Mixed	-	Mindful Self-Compassion (MSC)	8 weeks; weekly sessions	Depression
28	Bringmann et al., 2022	N = 81 adults (MBLM group: n =27; control group: n = 27; TAU group: n=27); Mage = 47.5 years; SD = 11.19; 80.25% female	Adults (≥18) diagnosed with mild/moderate depression (ICD-10) and BDI-II ≥10	Adults Clinical	-	Meditation-Based Lifestyle Modification (MBLM)	8 weeks, weekly sessions	Depression
29	Strangier et al., 2023	N = 48 adults (MBT group: n =24; WL group: n = 24); Mage = 50.25 years; SD = 11.28; 75% female	Adults with DSM-5 persistent depressive disorder diagnosed	Adults Clinical	-	Metta-based therapy (MBT)	8 weeks; weekly sessions, biweekly individual sessions, half-day retreat	Depression
30	Sajjadi et al., 2023	N = 44 adults (MSC group: n =21; control group: n = 23); Mage = 21.5 years; SD = 1.75; 57% female	Adults with a history of childhood maltreatment; baseline DASS-21 Depression: Int. M = 18.76, Ctrl. M = 19.13; Anxiety: Int. M = 17.33, Ctrl. M = 19.65.	Adults Mixed	Adults Mixed	Mindful Self-Compassion (MSC)	8 weeks; weekly sessions	Depression &Anxiety
31	Torrijos-Zarcero et al., 2021	N = 123 adults (MSC group: n =62; CBT group: n = 61); Mage = 48.76 years; SD = 10.75; 87.8% female	Adults with chronic pain and HADS anxiety or depression scores ≥8.	Adults Clinical	Adults Clinical	Mindful Self-Compassion (MSC)	8 weeks; weekly sessions	Depression &Anxiety
32	Benn et al., 2012	N = 60 adults (MT group: n =31; WL group: n = 29); Mage = 46.18 years; SD = 7.88; 91.67% female	Parents and special education educators; baseline CES-D Depression: Int. M = 33.18, Ctrl. M = 36.22; STAI Anxiety: Int. M = 40.10, Ctrl. M = 42.14.	Adults Mixed	Adults Mixed	Mindfulness Training (SMART-in-Education)	5 weeks; four half-days per week, home practice daily	Depression &Anxiety

(Continued from Table 1)

No.	Author(s)	Sample	Participants	Participant Type (Depression)	Participant Type (Anxiety)	Type of Intervention	Duration and Frequency	Outcome variables
33	Wren et al., 2019	N = 56 adults (LKM group: n =23; music group: n = 16; UC group: n=17); Mage = 55.37 years; SD = 12.49; 100 % female	Women undergoing diagnostic and surgical procedures for breast cancer without clinical diagnoses; baseline STAI Anxiety: Int. M = 41.72, Ctrl. M = 43.82.	-	Adults Healthy	Loving-Kindness Meditation (LKM)	3 weeks; a single session during the biopsy and daily practice	Anxiety
34	Koszycki et al., 2016	N = 39 adults (MBI-SAD group: n =21; WL group: n=18); Mage =39.77 years; SD = 15.3; 79.49 % female	Adults with Social Anxiety Disorder as defined by DSM criteria	Adults Mixed	Adults Clinical	Mindfulness-Based Intervention for Social Anxiety Disorder (MBI-SAD)	12 weeks; weekly sessions	Depression &Anxiety
35	Matos et al., 2017	N = 93 adults (CMT group: n =56; WL group: n=37); Mage =23.34 years; SD = 4.16; 90.3 % female	Young adults without clinical diagnoses; DASS-21 Depression: Int. M = 3.82, Ctrl. M = 3.86; Anxiety: Int. M = 3.00, Ctrl. M = 3.14.	Adults Healthy	Adults Healthy	Compassionate mind training (CMT)	2 weeks; a single 2-h session, home practice	Depression &Anxiety
36	Schuling et al., 2020	N = 122 adults (MBCL group: n =61; TAU group: n=61); Mage = 55.6 years; SD = 10.6; 74.6 % female	Adults with recurrent depression who previously participated in MBCT	Adults Mixed	-	Mindfulness-Based Compassionate Living (MBCL)	16 weeks; biweekly sessions	Depression
37	Teale Sapach & Carleton, 2023	N = 53 adults (SC group: n = 19; WL group: n=19; AR group: n=15) Mage = 34.3; SD = 11.4; 67.8% female	Adults diagnosed with social anxiety disorder (SAD) as per clinical diagnostic criteria	-	Adults Clinical	Mindful Self-Compassion (MSC)	8 weeks; weekly sessions, home practice	Anxiety
38	Goldberg et al., 2020	N=343 adults (Awareness + Connection group: n=121; Awareness + Insight group: n=107; WL group: n=115) Mage =41.74; SD = 12.52; 84.5% female	University-affiliated adults without clinical diagnoses or symptom-based inclusion; baseline PROMIS Depression: Int. M = 54.84, Ctrl. M = 55.34; Anxiety: Int. M = 58.50, Ctrl. M = 60.09	Adults Healthy	Adults Mixed	Healthy Minds Program (HMP): Awareness + Connection Group	8 weeks; daily practice	Depression &Anxiety
39	Lo et al., 2013	N = 82 adults (C-MT group: n = 41; WL group: n=41) Mage = 44.3 years; SD = 10.8; 73.2% female	Adults with BDI-II ≥15 or HADS-Anxiety ≥8	Adults Clinical	Adults Clinical	Compassion-Mindfulness Therapy (C-MT).	8 weeks; weekly sessions	Depression &Anxiety
40	Gutiérrez-Hernández et al., 2023	N = 139 adults (SCMI group: n =74; WL group: n=65); Mage =41.75 years; SD = 12.01; 84.3 % female	Adults experiencing COVID-19 lockdown stress; baseline DASS-21 Depression: Int. M = 11.56, Ctrl. M = 12.06; Anxiety: Int. M = 12.58, Ctrl. M = 11.51.	Adults Mixed	Adults Mixed	Self-Compassion and Mindfulness Intervention (SCMI)	10 weeks; weekly sessions	Depression &Anxiety

(Continued from Table 1)

No.	Author(s)	Sample	Participants	Participant Type (Depression)	Participant Type (Anxiety)	Type of Intervention	Duration and Frequency	Outcome variables
41	Zheng et al., 2022	N = 37 adults (SCT+CSE group: n =19; CSE group: n=18); Mage =35.25 years; SD = 11.08; 75.68 % female	Non-clinical adults with chronic low back pain and low baseline depression and anxiety symptoms (PHQ-9 = 5.9, 4.1; GAD-7 = 4.4, 3.7)	Adults Healthy	Adults Healthy	Self-Compassion Training (SCT)	4 weeks; weekly sessions	Depression &Anxiety
42	Khazraee et al., 2023	N = 31 adults (MH group: n =16; WL group: n=15); Mage =32.06 years; SD = 6.75; 100 % female	Adults with BDI-II >28 and DSM-5 diagnosis of major depressive disorder	Adults Clinical	-	Mindful Hypnotherapy (MH)	8 weeks; weekly sessions	Depression
43	Chen et al., 2024	N = 94 adults (LKM group: n =47; WL group: n=47); Mage =39.27 years; SD = 9.43; 63.8 % female	Chinese hospital doctors without clinical diagnoses; baseline CAI Communication Anxiety: Int. M = 2.84, Ctrl. M = 2.74.	-	Adults Mixed	Loving-Kindness Meditation (LKM)	8 weeks; 50-min practice three times per week	Anxiety
44	Ceclan & Nechita, 2021	N = 101 adults (self-kindness group: n =26; common humanity group: n=27; mindfulness group: n=25; control group: n=23); Mage = 21.14 years; SD = 2.69; 82% female	Adults diagnosed with Major Depressive Disorder	Adults Clinical	-	Mindful Self-Compassion (MSC)	3 weeks; weekly sessions	Depression
45	Lathan & Dritschel 2023	N = 50 adults; (LKM group: n =25; coloring group: n=25); Mage = 21.68 years; SD = 5.01; 68% female	Students with remitted depression from the University of St Andrews	Adults Mixed	-	Loving-Kindness Meditation (LKM)	4 weeks, daily sessions	Depression
46	Krieger et al., 2019	N = 121 participants (Intervention: n = 59; Control: n = 62); Mage = 37.68 years; SD = 11.45; 77.69% female	Adults with elevated self-criticism, recruited from the general population; baseline DASS-21 Depression: Int. M = 17.86, Ctrl. M = 17.90; Anxiety: Int. M = 8.85, Ctrl. M = 9.13.	Adults Mixed	Adults Mixed	Internet-based Compassion-Focused Intervention	8 weeks; weekly online sessions	Depression &Anxiety
47	Bower et al., 2021	N=247 female breast cancer survivors (MAPs: n = 81; SE: n=81; WL: n = 81); Mage = 45.4 years; SD = 6.4; 100% female	Women with early-stage breast cancer and mild or greater depressive symptoms (PHQ-8≥3)	Adults Mixed	-	Mindful awareness practices (MAPs)	6 weeks; weekly sessions, daily practices	Depression
48	Sengupta & Wagani 2024	N = 88 adults; (MSC group: n =45; WL group: n=43); Mage = 33.39 years; SD = 9.24; 67% female	Patients with skin conditions whose scores on the DASS-21 exceeded the clinical cut-offs for depression, anxiety, or stress	Adults Clinical	Adults Clinical	Mindful Self-Compassion (MSC)	4 weeks; online sessions twice a week	Depression &Anxiety
49	Naude et al., 2024	N = 50 adults; (MIND4IBD program group: n =25; WL group: n=25); Mage = 42.4 years; SD = 13.3; 84% female	Participants scored mild to moderate (16–29) on the Kessler Psychological Distress Scale (K10); without formal clinical diagnosis	Adults Mixed	Adults Mixed	Mind4IBD program	6 weeks; weekly sessions	Depression &Anxiety

Table 2: Risk of Bias Assessment for Included Studies

Study ID	Randomization process	Deviations from intended interventions	Missing outcome data	Measurement of the outcome	Selection of the reported result	Overall Bias
Soo et al., 2016	Low	Low	Low	Some concerns	Low	Some concerns
Lathan & Dritschel 2023	Low	Some concerns	Low	Some concerns	Low	Some concerns
Friis et al., 2016	Low	Low	Low	Low	Low	Low
Bringmann et al., 2022	Low	Low	Low	Low	Low	Low
Strangier et al., 2023	Low	Low	Low	Low	Low	Low
Sajjadi et al., 2023	Low	Low	Low	Some concerns	Low	Some concerns
Torrijos-Zarcero et al., 2021	Low	Low	Low	Low	Low	Low
Benn et al., 2012	Low	Low	Some concerns	Some concerns	Some concerns	Some concerns
Aizik-Reebs et al., 2021	Low	Low	Low	Some concerns	Some concerns	Some concerns
Wren et al., 2019	Low	Low	Low	Some concerns	Some concerns	Some concerns
Koszycki et al., 2016	Low	Low	Low	Low	Low	Low
Matos et al., 2017	Low	Low	Low	Some concerns	Some concerns	Some concerns
Schuling et al., 2020	Low	Low	Low	Some concerns	Low	Some concerns
Teale Sapach & Carleton, 2023	High	Low	Low	Some concerns	Low	High
Bower et al., 2021	Low	Low	Low	Some concerns	Low	Some concerns
Goldberg et al., 2020	Low	Low	Low	Some concerns	Low	Some concerns
Lo et al., 2013	Low	Low	Low	Some concerns	Low	Some concerns
Gutiérrez-Hernández et al., 2023	Some concerns	High	Low	Some concerns	Some concerns	High
Zheng et al., 2022	Low	Low	Low	Low	Low	Low
Khazraee et al., 2023	Low	Low	Low	Low	Low	Low
Chen et al., 2024	Low	Low	Low	Low	Low	Low
Ceclan & Nechita, 2021	Low	Low	Low	Low	Low	Low
Rojas et al., 2023	Low	Low	Low	Some concerns	Low	Some concerns
Aguilar-Raab et al., 2023	Low	Low	Low	Some concerns	Low	Some concerns

(Continued from Table 2)

Study ID	Randomization process	Deviations from intended interventions	Missing outcome data	Measurement of the outcome	Selection of the reported result	Overall Bias
Lo et al., 2017	Low	Low	Low	Some concerns	Low	Some concerns
Cheng et al., 2024	Low	Low	Low	Some concerns	Low	Some concerns
Haukaas et al., 2018	Low	Low	Low	Some concerns	Some concerns	Some concerns
Zhou et al., 2021	Low	Low	Low	Some concerns	Some concerns	Some concerns
Pagliaro et al., 2016	Low	Low	Low	Low	Some concerns	Some concerns
Al-Refae et al., 2021	High	Low	Low	Some concerns	Some concerns	High
Shahar et al., 2015	Low	Low	Low	Some concerns	Some concerns	Some concerns
Mongrain et al., 2018	Low	Low	Low	Some concerns	Some concerns	Some concerns
Krieger et al., 2019	Some concerns	Low	Low	Some concerns	Some concerns	Some concerns
Liu et al., 2021	Low	Low	Low	Some concerns	Low	Some concerns
Asano et al., 2022	Low	Low	Low	Some concerns	Some concerns	Some concerns
Mantzios et al., 2019	Low	Low	Low	Some concerns	Some concerns	Some concerns
Lang et al., 2020	Low	Low	Low	Low	Some concerns	Some concerns
Hudson et al., 2020	Low	Some concerns	Low	Some concerns	Some concerns	Some concerns
Bolognino et al., 2023	Low	Some concerns	Low	Some concerns	Some concerns	Some concerns
Dundas et al., 2017	Low	Low	Low	Some concerns	Some concerns	Some concerns
Hansen et al., 2021	Low	Low	Low	Low	Low	Low
Sahraian et al., 2024	Low	Low	Low	Low	Low	Low
Garrote-Caparrós et al, 2023	Low	Low	Low	Low	Low	Low
Rubin et al., 2024	Low	Low	Low	Some concerns	Low	Some concerns
Montero-Marín et al., 2018	Low	Low	Low	Low	Low	Low
Slivjak et al., 2022	Low	Low	Low	Some concerns	Low	Some concerns
Beshai et al., 2020	Low	Low	Low	Some concerns	Low	Some concerns
Sengupta & Wagani (2024)	Some concerns	Low	Low	Some concerns	Low	Some concerns
Naude et al. (2024)	Low	Low	Low	Some concerns	Low	Some concerns

Table 3: Summary of Depression Studies in SG-MBI Meta-Analysis

Study ID	Participant Type	Primary outcome status	Rob of risk bias	Intervention Group	Intervention Type	Intervention Component	Control Group Type	n SG-MBI	n Ctrl	Outcome Measure	Intervention Duration	g
Bringmann et al. (2022)	Adults Clinical	Primary	Low	Meditation-Based Lifestyle Modification (MBLM)	others	Others	Passive Control	27	27	BDI-II	8	0.90
Schuling et al. (2020)	Adults Mixed	Primary	Some concerns	Mindfulness-Based Compassionate Living (MBCL)	others	Self-Compassion	Passive Control	61	61	BDI-II	8	0.17
Aguilar-Raab et al. (2023)	Adults Clinical	Primary	Some concerns	Cognitively-Based Compassion Training for Couples (CBCT-fC)	CBCT	Other-Compassion	Active Control	27	22	HDRS	10	0.63
Asano et al. (2022)	Adults Clinical	Primary	Some concerns	Compassion-focused therapy (CFT)	CFT	Other-Compassion	Passive Control	10	7	BDI-II	12	1.59
Sahraian et al (2024)	Adults Mixed	Primary	Low	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Passive Control	25	25	SCL-R-90	8	2.19
Beshai et al. (2020)	Adults Mixed	Primary	Some concerns	Mindfulness and self-compassion online program (Mind-OP)	others	Self-Compassion	Active Control	68	91	PHQ-9	4	0.31
Lathan & Dritschel (2023)	Adults Mixed	Primary	Some concerns	Loving-Kindness Meditation (LKM)	LKM	Other-Compassion	Active Control	25	25	DASS	4	0.36
Strangier et al. (2023)	Adults Clinical	Primary	Low	Metta-based therapy	others	Other-Compassion	Passive Control	24	24	BDI-II	8	-0.51
Lo et al. (2013)	Adults Clinical	Primary	Some concerns	Compassion-Mindfulness Therapy (C-MT)	others	Other-Compassion	Passive Control	41	41	BDI-II	8	0.78
Ceclan et al. (2021)	Adults Clinical	Primary	Low	Self-compassion components (self-kindness)	MSC	Self-Compassion	Active Control	26	23	BDI-II	3	0.05
Lo et al. (2017)	Adults Clinical	Primary	Some concerns	A Brief Mindfulness-Based Program	others	Others	Passive Control	83	82	CES-D	6	0.30
Rojas et al. (2023)	Adults Healthy	Primary	Some concerns	Compassion Cultivation Training (CCT)	CCT	Other-Compassion	Passive Control	22	22	DASS	8	0.73

(Continued from Table 3)

Study ID	Participant Type	Primary outcome status	Rob of risk bias	Intervention Group	Intervention Type	Intervention Component	Control Group Type	n SG-MBI	n Ctrl	Outcome Measure	Intervention Duration	g
Cheng et al. (2024)	Adults Clinical	Non-Primary	Some concerns	REMIND 2.0 (Tailored Mindfulness-Based Intervention)	others	Self-Compassion	Active Control	14	14	DASS	8	3.40
Haukaas et al. (2018)	Adults Mixed	Primary	Some concerns	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Active Control	41	40	PHQ-9	3	-0.15
Zhou et al. (2021)	Adults Healthy	Primary	Some concerns	Mindfulness-based positive psychology (MBPP)	others	Others	Passive Control	69	69	DASS	6	0.61
Pagliaro et al. (2016)	Adults Mixed	Primary	Some concerns	Tong Len meditation	others	Other-Compassion	Passive Control	52	51	POMS	12	-0.08
Al-Refae et al. (2021)	Adults Mixed	Primary	High	A Self-Compassion and Mindfulness-Based Cognitive Mobile Intervention (Serene)	others	Self-Compassion	Passive Control	78	87	DASS	4	0.30
Shahar et al. (2015)	Adults Healthy	Primary	Some concerns	Loving-Kindness Meditation (LKM)	LKM	Other-Compassion	Passive Control	14	18	DASS	7	0.48
Mongrain et al. (2018)	Adults Mixed	Primary	Some concerns	Loving-Kindness Meditation (LKM)	LKM	Other-Compassion	Active Control	71	61	CES-D	3	0.49
Liu et al. (2021)	Adults Mixed	Non-Primary	Some concerns	Mindful Parenting Program (MPP)	others	Others	Passive Control	58	55	HDRS	8	0.57
Aizik-Reebs et al. (2021)	Adults Clinical	Primary	Some concerns	Mindfulness-Based Trauma Recovery for Refugees (MBTR-R)	others	Others	Passive Control	17	29	PHQ-9	9	0.76
Lang et al. (2020)	Adults Clinical	Primary	Some concerns	Cognitively-Based Compassion Training for Vet (CBCT-Vet)	CBCT	Other-Compassion	Active Control	14	14	BSI-18	10	0.28
Hudson et al. (2020)	Adults Mixed	Non-Primary	Some concerns	Compassion-focused therapy (CFT self-help)	CFT	Other-Compassion	Passive Control	85	91	HADS-D	2	0.10

(Continued from Table 3)

Study ID	Participant Type	Primary outcome status	Rob of risk bias	Intervention Group	Intervention Type	Intervention Component	Control Group Type	n SG-MBI	n Ctrl	Outcome Measure	Intervention Duration	g
Lang et al. (2020)	Adults Clinical	Primary	Some concerns	Cognitively-Based Compassion Training for Vet (CBCT-Vet)	CBCT	Other-Compassion	Active Control	14	14	BSI-18	10	0.28
Hudson et al. (2020)	Adults Mixed	Non-Primary	Some concerns	Compassion-focused therapy (CFT self-help)	CFT	Other-Compassion	Passive Control	85	91	HADS-D	2	0.10
Bolognino et al. (2023)	Adults Mixed	Primary	Some concerns	Loving-Kindness Meditation (LKM)	LKM	Other-Compassion	Active Control	14	14	CES-D	2	1.03
Dundas et al. (2017)	Adults Mixed	Non-Primary	Some concerns	Self-compassion intervention for students	MSC	Self-Compassion	Passive Control	53	64	MDI	2	0.16
Hansen et al. (2021)	Adults Mixed	Primary	Low	Compassion cultivation training (CCT)	CCT	Other-Compassion	Passive Control	76	79	DASS	8	0.38
Garrote-Caparrós et al (2023)	Adults Mixed	Primary	Low	Mindfulness and Compassion-Based Intervention (MCBI)	others	Others	Active Control	65	74	BSI-18	8	0.28
Rubin et al. (2024)	Adults Mixed	Non-Primary	Some concerns	Mindfulness and Compassion (MC)	others	Others	Passive Control	30	30	PHQ-8	1	0.46
Montero-Marín et al. (2018)	Adults Mixed	Non-Primary	Low	Attachment-based compassion therapy (ABCT)	others	Other-Compassion	Active Control	20	15	HADS-D	8	0.70
Friis et al. (2016)	Adults Mixed	Primary	Low	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Passive Control	32	31	PHQ-9	8	-0.32
Sajjadi et al. (2023)	Adults Mixed	Primary	Some concerns	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Passive Control	21	23	DASS	8	1.33
Torrijos-Zarcero et al. (2021)	Adults Clinical	Non-Primary	Low	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Active Control	62	61	HADS-D	8	0.13

(Continued from Table 3)

Study ID	Participant Type	Primary outcome status	Rob of risk bias	Intervention Group	Intervention Type	Intervention Component	Control Group Type	n SG-MBI	n Ctrl	Outcome Measure	Intervention Duration	g
Benn et al. (2012)	Adults Mixed	Primary	Some concerns	Mindfulness Training (SMART-in-Education)	others	Others	Passive Control	31	30	CES-D	5	0.70
Koszycki et al. (2016)	Adults Mixed	Primary	Low	Mindfulness-Based Intervention for Social Anxiety Disorder (MBI-SAD)	others	Others	Passive Control	21	18	BDI-II	12	0.80
Matos et al. (2017)	Adults Healthy	Primary	Some concerns	Compassionate mind training (CMT)	others	Other-Compassion	Passive Control	56	37	DASS	2	0.29
Goldberg et al. (2020)	Adults Healthy	Primary	Some concerns	Healthy Minds Program (HMP): Awareness + Connection Group	others	Others	Passive Control	121	115	PROMIS	8	0.34
Gutiérrez-Hernández et al. (2023)	Adults Mixed	Primary	High	Self-Compassion and Mindfulness Intervention (SCMI)	others	Self-Compassion	Passive Control	74	65	DASS	10	0.51
Zheng et al. (2022)	Adults Healthy	Non-Primary	Low	Self-Compassion Training (SCT)	others	Self-Compassion	Active Control	19	18	PHQ-9	4	-0.53
Khazraee et al. (2023)	Adults Clinical	Primary	Low	Mindful Hypnotherapy (MH)	others	Others	Passive Control	16	15	BDI-II	8	2.33
Krieger et al. (2019)	Adults Mixed	Primary	Some concerns	Internet-based Compassion-Focused Intervention	others	Other-Compassion	Passive Control	59	62	DASS	8	0.72
Bower et al. (2021)	Adults Mixed	Primary	Some concerns	mindful awareness practices (MAPs)	others	Others	Passive Control	85	81	CES-D	6	0.24

(Continued from Table 3)

Study ID	Participant Type	Primary outcome status	Rob of risk bias	Intervention Group	Intervention Type	Intervention Component	Control Group Type	n SG-MBI	n Ctrl	Outcome Measure	Intervention Duration	g
Sengupta & Wagani (2024)	Adults Clinical	Primary	Some concerns	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Passive Control	45	43	DASS	4	6.44
Naude et al. (2024)	Adults Mixed	Non-Primary	Some concerns	Mind4IBD program	others	Self-Compassion	Passive Control	25	25	DASS	6	0.38

Note: TAU=Treatment As Usual; BDI-II=Beck Depression Inventory – Second Edition; HDRS=Hamilton Depression Rating Scale; SCL-90-R=Symptom Checklist-90-Revised; PHQ-9=Patient Health Questionnaire-9; DASS=Depression, Anxiety, and Stress Scale; POMS=Profile of Mood States; PHQ-8=Patient Health Questionnaire-8; CES-D=Center for Epidemiologic Studies Depression Scale; HAMD=Hamilton Rating Scale for Depression; BSI-18=Brief Symptom Inventory-18; HADS-D=Hospital Anxiety and Depression Scale – Depression subscale; MDI=Major Depression Inventory; PROMIS=Patient-Reported Outcomes Measurement Information System

Table 4: Summary of Anxiety Studies in SG-MBI Meta-Analysis

Study ID	Participant Type	Primary outcome status	Rob of risk bias	Intervention Group	Intervention Type	Intervention Component	Control Group Type	n SG-MBI	n Ctrl	Outcome Measure	Intervention Duration	g
Beshai et al. (2020)	Adults Mixed	Primary	Some concerns	Mindfulness and self-compassion online program (Mind-OP)	others	Self-Compassion	Active Control	68	68	GAD-7	4	0.52
Sahraian et al. (2024)	Adults Mixed	Primary	Low	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Passive Control	25	25	SCL-90-R	8	1.61
Lo et al. (2013)	Adults Clinical	Primary	Some concerns	Compassion-Mindfulness Therapy (C-MT).	others	Other-Compassion	Passive Control	41	41	HADS-A	8	0.50
Slivjak et al. (2022)	Adults Mixed	Primary	Some concerns	Common humanity-enhanced exposure	others	Others	Active Control	32	31	SUDS	1	0.03
Rojas et al. (2023)	Adults Healthy	Primary	Some concerns	Compassion Cultivation Training (CCT)	CCT	Other-Compassion	Passive Control	22	22	DASS	8	0.75
Cheng et al. (2024)	Adults Clinical	Non-Primary	Some concerns	REMIND 2.0 (Tailored Mindfulness-Based Intervention)	others	Self-Compassion	Active Control	14	14	DASS	8	0.49
Haukaas et al. (2018)	Adults Mixed	Primary	Some concerns	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Active Control	41	40	GAD-7	3	-0.36
Zhou et al. (2021)	Adults Healthy	Primary	Some concerns	Mindfulness-based positive psychology (MBPP)	others	Others	Passive Control	69	69	DASS	6	0.62
Pagliaro et al. (2016)	Adults Mixed	Primary	Some concerns	Tong Len meditation	others	Other-Compassion	Passive Control	52	51	POMS	12	-0.31
Al-Refae et al. (2021)	Adults Mixed	Primary	High	A Self-Compassion and Mindfulness-Based Cognitive Mobile Intervention (Serene)	others	Self-Compassion	Passive Control	78	87	DASS	4	0.19
Shahar et al. (2015)	Adults Healthy	Primary	Some concerns	Loving-Kindness Meditation (LKM)	LKM	Other-Compassion	Passive Control	14	18	DASS	7	0.00

(Continued from Table 4)

Study ID	Participant Type	Primary outcome status	Rob of risk bias	Intervention Group	Intervention Type	Intervention Component	Control Group Type	n SG-MBI	n Ctrl	Outcome Measure	Intervention Duration	g
Liu et al. (2021)	Adults Mixed	Non-Primary	Some concerns	Mindful Parenting Program (MPP)	others	Other-Compassion	Passive Control	58	55	HAMA	8	0.34
Aizik-Reebs et al. (2021)	Adults Clinical	Primary	Some concerns	Mindfulness-Based Trauma Recovery for Refugees (MBTR-R)	others	Others	Passive Control	19	19	BAI	9	0.56
Mantzios et al. (2019)	Adults Healthy	Primary	Some concerns	Loving-Kindness Meditation (LKM)	LKM	Other-Compassion	Active Control	40	40	SAI	1	0.15
Lang et al. (2020)	Adults Clinical	Primary	Some concerns	CBCT-Vet	others	Other-Compassion	Active Control	14	14	BSI-18	10	0.75
Hudson et al. (2020)	Adults Mixed	Non-Primary	Some concerns	CFT self-help	others	Other-Compassion	Passive Control	85	91	HADS-A	2	0.11
Bolognino et al. (2023)	Adults Mixed	Primary	Some concerns	Loving-Kindness Meditation (LKM)	LKM	Other-Compassion	Active Control	14	14	GAD-7	2	1.14
Dundas et al. (2017)	Adults Mixed	Non-Primary	Some concerns	Self-compassion intervention for students	MSC	Self-Compassion	Passive Control	53	64	STAI	2	0.45
Hansen et al. (2021)	Adults Mixed	Primary	Low	Compassion cultivation training (CCT)	CCT	Other-Compassion	Passive Control	74	82	DASS	8	0.26
Garrote-Caparrós et al. (2023)	Adults Mixed	Primary	Low	Mindfulness and Compassion-Based Intervention (MCBI)	others	Others	Active Control	65	74	BSI-18	8	0.43
Rubin et al. (2024)	Adults Mixed	Non-Primary	Some concerns	Mindfulness and Compassion (MC)	others	Others	Passive Control	30	30	GAD-7	1	1.03
Montero-Marín et al. (2018)	Adults Mixed	Non-Primary	Low	Attachment-based compassion therapy (ABCT)	others	Other-Compassion	Active Control	23	19	HADS-A	8	0.72

(Continued from Table 4)

Study ID	Participant Type	Primary outcome status	Rob of risk bias	Intervention Group	Intervention Type	Intervention Component	Control Group Type	n SG-MBI	n Ctrl	Outcome Measure	Intervention Duration	g
Soo et al. (2016)	Adults Mixed	Primary	Some concerns	Loving-Kindness Meditation (LKM)	LKM	Other-Compassion	Active Control	41	40	STAI	1	2.01
Sajjadi et al. (2023)	Adults Mixed	Primary	Some concerns	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Passive Control	21	23	DASS	8	1.84
Torrijos-Zarcero et al. (2021)	Adults Clinical	Non-Primary	Low	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Active Control	62	61	HADS-A	8	0.17
Benn et al. (2012)	Adults Mixed	Primary	Some concerns	Mindfulness Training (SMART-in-Education)	others	Others	Passive Control	31	30	STAI	5	0.65
Wren et al. (2019)	Adults Mixed	Primary	Some concerns	Loving-Kindness Meditation (LKM)	LKM	Other-Compassion	Passive Control	23	17	STAI	3	0.09
Koszycki et al. (2016)	Adults Clinical	Primary	Low	Mindfulness-Based Intervention for Social Anxiety Disorder (MBI-SAD)	others	Other-Compassion	Passive Control	21	18	LSAS	12	1.78
Matos et al. (2017)	Adults Healthy	Primary	Some concerns	Compassionate mind training (CMT)	others	Other-Compassion	Passive Control	56	37	DASS	2	0.31
Teale Sapach & Carleton (2023)	Adults Clinical	Primary	High	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Passive Control	33	21	LSAS-SR	8	0.62
Goldberg et al. (2020)	Adults Mixed	Primary	Some concerns	Healthy Minds Program (HMP): Awareness + Connection Group	others	Others	Passive Control	121	115	PROMIS	8	0.44
Gutiérrez-Hernández et al. (2023)	Adults Mixed	Primary	High	Self-Compassion and Mindfulness Intervention (SCMI)	others	Self-Compassion	Passive Control	74	65	DASS	10	0.31

(Continued from Table 4)

Study ID	Participant Type	Primary outcome status	Rob of risk bias	Intervention Group	Intervention Type	Intervention Component	Control Group Type	n SG-MBI	n Ctrl	Outcome Measure	Intervention Duration	g
Zheng et al. (2022)	Adults Healthy	Non-Primary	Low	Self-Compassion Training (SCT)	others	Self-Compassion	Active Control	19	18	GAD-7	4	0.33
Chen et al. (2024)	Adults Healthy	Primary	Low	Loving-Kindness Meditation (LKM) Internet-based	LKM	Other-Compassion	Passive Control	47	47	CAI	8	0.59
Krieger et al. (2019)	Adults Mixed	Primary	Some concerns	Compassion-Focused Intervention	others	Other-Compassion	Passive Control	59	62	DASS	8	0.46
Sengupta & Wagani (2024)	Adults Clinical	Primary	Some concerns	Mindful Self-Compassion (MSC)	MSC	Self-Compassion	Passive Control	45	43	DASS	4	5.49
Naude et al. (2024)	Adults Mixed	Non-Primary	Some concerns	Mind4IBD program	others	Self-Compassion	Passive Control	25	25	DASS	6	-0.22

Note: TAU=Treatment As Usual; GAD-7=Generalized Anxiety Disorder 7-item scale; SCL-90-R=Symptom Checklist-90-Revised; HADS-A=Hospital Anxiety and Depression Scale - Anxiety subscale; SUDS=Subjective Units of Distress Scale;POMS=Profile of Mood States; HAMA=Hamilton Anxiety Rating Scale; BAI=Beck Anxiety Inventory; SAI=State Anxiety Inventory; BSI-18=Brief Symptom Inventory-18; STAI=State-Trait Anxiety Inventory; DASS=Depression, Anxiety, and Stress Scale; LSAS=Liebowitz Social Anxiety Scale; PROMIS=Patient-Reported Outcomes Measurement Information System; CAI: Cognitive and Affective Inventory;

Table 5: Overview of Weighted MID Estimates and Clinical Thresholds for Common Depression and Anxiety Measures

Domain	Outcome Measure	Number of Studies	Total N	Weighted MID (mean)	Clinically Meaningful Change (MID/MCID) Reference
Depression	BDI-II	8	442	4.52	3–6 points (Hengartner & Plöderl, 2022)
Depression	PHQ-9/PHQ-8	6	446	2.32	3.7 points (Bauer-Staeb et al., 2021)
Depression	HADS-D	3	334	1.91	1.5-1.7 points (Smid et al., 2017)
Depression	DASS-21	13	1147	2.72	5 points (Yohannes et al., 2022)
Depression	CES-D	5	552	5.35	9 points (Haase et al., 2016)
Depression	PROMIS	1	236	4.00	T scores:3-4 points (Kroenke et al., 2020)
Depression	HDRS	2	162	3.73	3–5 points (Hengartner & Plöderl, 2022)
Anxiety	GAD-7	5	342	2.22	3.3 points (Bauer-Staeb et al., 2021)
Anxiety	HADS-A	4	423	1.68	1.3-1.8 points (Smid et al., 2017)
Anxiety	DASS-21	12	1098	2.32	5 points (Yohannes et al., 2022)
Anxiety	STAI	4	299	4.14	10 points (Corsaletti et al., 2014)
Anxiety	PROMIS	1	236	3.68	T scores:3-4 points (Kroenke et al., 2020)

Note: MID values in this table were estimated using a distribution-based approach, calculated as 0.5 times the baseline standard deviation of the intervention group in each study. The weighted MID represents the average MID across studies for each scale, weighted by the intervention group's baseline sample size. Total N includes both intervention and control participants at baseline and serves descriptive purposes only. MID for STAI was derived from a smoking population, generalizability may be limited.

Table 6: Summary of Subgroup Analyses for SG-MBIs on Depression and Anxiety Outcomes

Moderator Variable	k	Pre (M ± SD)	Post (M ± SD)	Hedges' g	95% CI	p-value	NNT	QM (df)	QM p-value	Power RE
Participant Type (Depression)	-			-	-	-		8.66	**0.01**	0.8302
Clinical	13	24.2±7.6	15.3±8.4	1.22	[0.57, 1.87]	**<.001**	2.3			
Healthy	6	24.1±5.6	23.6±5.3	0.34	[0.07, 0.62]	**0.01**	10.0			
Mixed	24	17.7±8.2	12.7±7.6	0.42	[0.27, 0.57]	**<.001**	7.9			
Participant Type (Anxiety)	-			-	-	-		7.03	**0.03**	0.6845
Clinical	8	31.1±10.7	20.6±11.2	1.26	[0.34, 2.18]	**0.007**	2.2			
Healthy	7	4.1±2.7	3.2±2.2	0.42	[0.23, 0.60]	**<.001**	7.9			
Mixed	22	24.2±7.5	20.2±7.3	0.48	[0.28, 0.69]	**<.001**	6.8			
Control Group (Depression)	-			-	-	-		1.31	0.25	0.1066
Passive Control	30	20.9±7.6	16.1±7.5	0.67	[0.44, 0.91]	**<.001**	4.6			
Active Control	13	16.0±8.1	11.6±7.2	0.40	[0.12, 0.68]	**0.005**	8.4			
Control Group (Anxiety)	-			-	-	-		0.45	0.50	0.0889
Passive Control	25	22.8±7.9	18.7±7.4	0.66	[0.40, 0.92]	**<.001**	4.7			
Active Control	12	19.7±6.5	14.8±7.7	0.50	[0.18, 0.82]	**0.002**	6.5			

(Continued from Table 6)

Moderator Variable	k	Pre (M ± SD)	Post (M ± SD)	Hedges' g	95% CI	p-value	NNT	QM (df)	QM p-value	Power RE
Intervention Component (Depression)	-			-	-	-		1.35	0.51	0.1971
Self-Compassion	15	15.9±6.6	11.0±6.9	0.82	[0.35, 1.29]	**<.001**	3.6			
Other-Compassion	16	19.4±8.9	13.5±8.1	0.42	[0.23, 0.61]	**<.001**	7.9			
Others	12	24.0±7.6	21.0±7.4	0.56	[0.36, 0.76]	**<.001**	5.7			
Intervention Component (Anxiety)	-			-	-	-		0.99	0.61	0.1451
Self-Compassion	13	19.0±7.9	12.6±7.3	0.81	[0.33, 1.29]	**<.001**	3.7			
Other-Compassion	17	18.1±6.8	13.9±6.0	0.53	[0.27, 0.78]	**<.001**	6.0			
Others	7	33.4±8.2	33.6±9.8	0.47	[0.31, 0.64]	**<.001**	6.9			
Intervention Type (Depression)	-			-	-	-		11.57	**0.04**	0.0944
CBCT	2	41.1±10.2	31.9±11.4	0.48	[–0.01, 0.97]	0.06	6.8			
CFT	2	9.9±4.1	8.1±4.0	0.74	[–0.71, 2.18]	0.32	4.1			
MSC	8	19.3±5.7	12.9±6.5	1.14	[0.23, 2.06]	**0.01**	2.5			
LKM	4	15.8±11.9	11.2±9.2	0.52	[0.26, 0.78]	**<.001**	6.2			
CCT	2	9.5±7.8	6.7±7.5	0.45	[0.16, 0.75]	**0.003**	7.3			
Intervention Type (Anxiety)	-			-	-	-		12.72	**0.005**	0.1485
MSC	7	28.1±9.7	19.0±9.0	1.35	[0.35, 2.35]	**0.008**	2.1			
LKM	6	19.8±4.9	14.2±3.8	0.66	[0.04, 1.29]	**0.04**	4.7			
CCT	2	6.5±6.1	4.6±4.8	0.43	[–0.03, 0.88]	0.07	7.7			

Moderator Variable	k	Pre (M ± SD)	Post (M ± SD)	Hedges' g	95% CI	p-value	NNT	QM (df)	QM p-value	Power RE
Outcome Measure (Depression)	-			-	-	-		8.91	0.06	0.5022
DASS-21	13	10.7±4.7	6.9±5.4	1.08	[0.60, 1.56]	**<.001**	2.6			
CES-D	5	21.8±10.9	16.9±9.2	0.43	[0.22, 0.63]	**<.001**	7.7			
BDI-II	8	25.0±9.2	14.2±10.1	0.68	[0.17, 1.18]	**0.009**	4.5			
PHQ-8/9	6	10.3±4.7	6.9±5.4	0.08	[–0.28, 0.43]	0.67	47.6			
HADS-D	3	9.0±3.8	7.7±3.9	0.19	[–0.07, 0.44]	0.15	19.1			
Outcome Measure (Anxiety)	-			-	-	-		1.37	0.71	0.1436
STAI	4	45.6±8.9	37.7±8.1	0.80	[0.02, 1.59]	**0.046**	3.7			
DASS-21	12	8.1±5.4	5.5±4.7	0.80	[0.31, 1.29]	**0.001**	3.7			
GAD-7	5	7.9±4.5	4.7±4.1	0.48	[–0.03, 0.98]	0.07	6.8			
HADS-A	4	12.0±3.4	9.9±4.0	0.27	[0.03, 0.51]	**0.03**	13			
Primary Outcome Status (Depression)								0.61	0.43	0.1378
Primary	34	21.7±8.2	16.2±7.9	0.64	[0.42, 0.85]	**<.001**	4.8			
Non-Primary	9	11.6±5.0	9.7±5.0	0.43	[0.06, 0.80]	**0.02**	7.7			
Primary Outcome Status (Anxiety)								1.88	0.17	0.2925
Primary	28	23.8±7.9	18.7±8.0	0.70	[0.44, 0.96]	**<.001**	4.4			
Non-Primary	9	15.8±5.9	13.7±5.4	0.31	[0.11, 0.50]	**0.002**	11.1			

Moderator Variable	k	Pre (M ± SD)	Post (M ± SD)	Hedges' g	95% CI	p-value	NNT	QM (df)	QM p-value	Power RE
Risk of Bias Status (Depression)								1.03	0.60	0.1197
Low	12	18.1±6.9	11.1±7.4	0.48	[0.09, 0.88]	**0.02**	6.8			
Some Concerns	29	20.9±8.0	16.8±7.5	0.67	[0.44, 0.90]	**<.001**	4.6			
High	2	13.9±7.7	10.6±7.5	0.39	[0.16, 0.62]	**<.001**	8.6			
Risk of Bias Status (Anxiety)								0.63	0.73	0.1883
Low	8	13.6±6.5	9.5±6.0	0.67	[0.32, 1.01]	**<.001**	4.7			
Some Concerns	26	24.0±7.0	20.4±7.2	0.63	[0.35, 0.90]	**<.001**	4.9			
High	3	24.9±11.4	16.0±10.8	0.28	[0.07, 0.50]	**0.01**	12.5			

Note: Pre (M ± SD) and Post (M ± SD) represent the pooled mean and standard deviation across intervention groups; Hedges' g represents the standardized mean difference between intervention and control groups at post-intervention, adjusted for small sample bias; 95% CI = 95% confidence interval; QM and p-values represent the test of moderators in meta-regression; Moderator models for participant type used default dummy coding with the Clinical group as the reference category. All moderator models used default dummy coding with a reference category, except for Intervention Type, which used a no-intercept specification to obtain independent estimates and to accommodate categories with small sample sizes (k = 2) ; Power RE values were derived using the metapower package (Griffin, 2021), indicating the statistical power under random-effects assumptions.; NNT was computed using Furukawa's method (Furukawa, 1999), based on the Hedges' g. Primary Outcome Status indicates whether depression or anxiety symptoms were designated as the primary outcome in the original trial (coded as Primary or Non-Primary); Risk of Bias Status was evaluated using the Cochrane RoB 2 tool and coded as Low, Some Concerns, or High.

Table 7 Subgroup and Moderator Analyses of Follow-Up Effects for Depression and Anxiety

Moderator Variable	k	Pre (M ± SD)	Follow-up (M ± SD)	Hedges' g	95% CI	p-value	NNT	QM (df)	QM p-value	Power RE
Participant Type (Depression)	-			-	-	-		17.16	**<.001**	0.9999
Clinical	3	24.2±7.6	10.9±8.8	3.05	[0.31, 5.80]	**0.029**	1.2			
Healthy	3	24.1±5.6	2.7±2.0	0.18	[−0.21, 0.58]	0.36	20.2			
Mixed	11	17.7±8.2	12.3±7.2	0.47	[0.14, 0.80]	**0.006**	6.9			
Control Group (Depression)	-			-	-	-		0.90	0.34	0.0733
Passive Control	11	20.9±7.6	11.5±7.3	0.78	[0.42, 1.14]	**<.001**	3.8			
Active Control	6	16.0±8.1	9.6±6.1	0.58	[−0.19, 1.35]	0.137	5.4			
Control Group (Anxiety)	-			-	-	-		3.39	0.07	0.2929
Passive Control	8	22.8±7.9	10.8±5.2	0.63	[0.33, 0.93]	**<.001**	4.9			
Active Control	5	19.7±6.5	7.6±2.8	-0.21	[−1.46, 1.04]	0.743	-			
Intervention Component (Depression)	-			-	-	-		1.05	0.59	0.0815
Self-Compassion	7	15.9±6.6	10.4±3.4	1.03	[0.18, 1.89]	**0.018**	2.8			
Other-Compassion	4	19.4±8.9	8.7±8.1	0.36	[0.14, 0.59]	**0.002**	9.4			
Others	6	24.0±7.6	12.8±8.5	0.68	[0.19, 1.18]	**0.007**	4.5			

(Continued from Table 7)

Moderator Variable	k	Pre (M ± SD)	Follow-up (M ± SD)	Hedges' g	95% CI	p-value	NNT	QM (df)	QM p-value	Power RE
Intervention Component (Anxiety)	-			-	-	-		0.37	0.83	0.0638
Self-Compassion	6	19.0±7.9	8.0±3.1	0.16	[−0.98, 1.31]	0.78	23.0			
Other-Compassion	4	18.1±6.8	9.4±5.8	0.42	[0.16, 0.67]	**0.001**	7.9			
Others	3	33.4±8.2	13.3±5.2	0.49	[0.22, 0.75]	**<.001**	6.6			

Note: Pre (M ± SD) and Follow-up (M ± SD) indicate the weighted mean and pooled standard deviation of symptom scores at baseline and follow-up in the intervention group; Hedges' g represents the standardized mean difference between intervention and control groups at follow-up, adjusted for small sample bias; 95% CI = 95% confidence interval; QM and p-values represent the test of moderators in meta-regression; Power RE values were derived using the metapower package (Griffin, 2021), indicating the statistical power under random-effects assumptions.; NNT was computed using Furukawa's method (Furukawa, 1999), based on the Hedges' g.

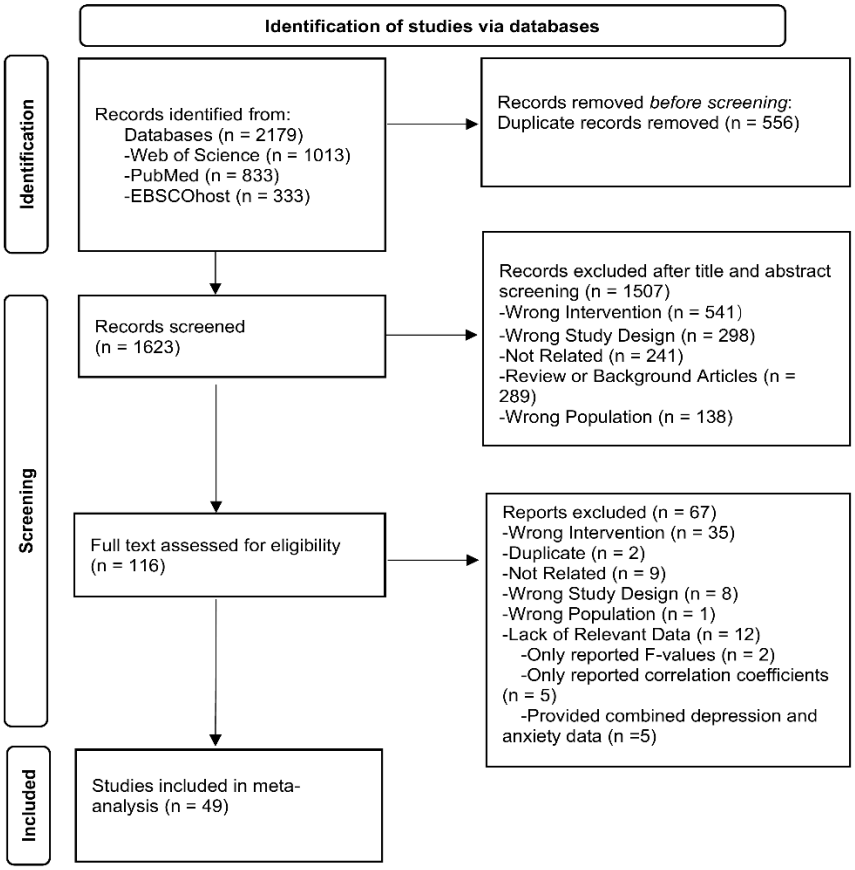

Figure 1: Flowchart of Study Selection for Meta-Analysis

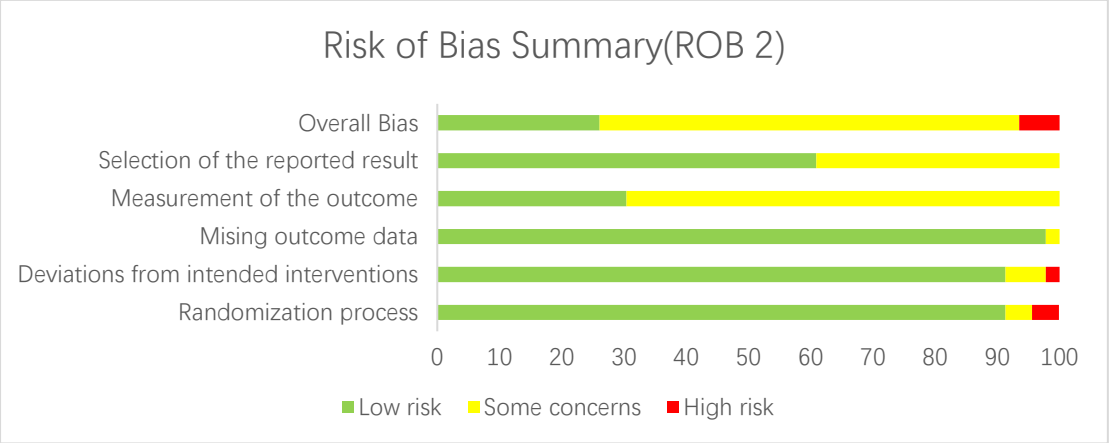

Figure 2: Risk of bias summary for included randomized controlled trials based on the Cochrane ROB 2 tool. Green = low risk; yellow = some concerns; red = high risk.

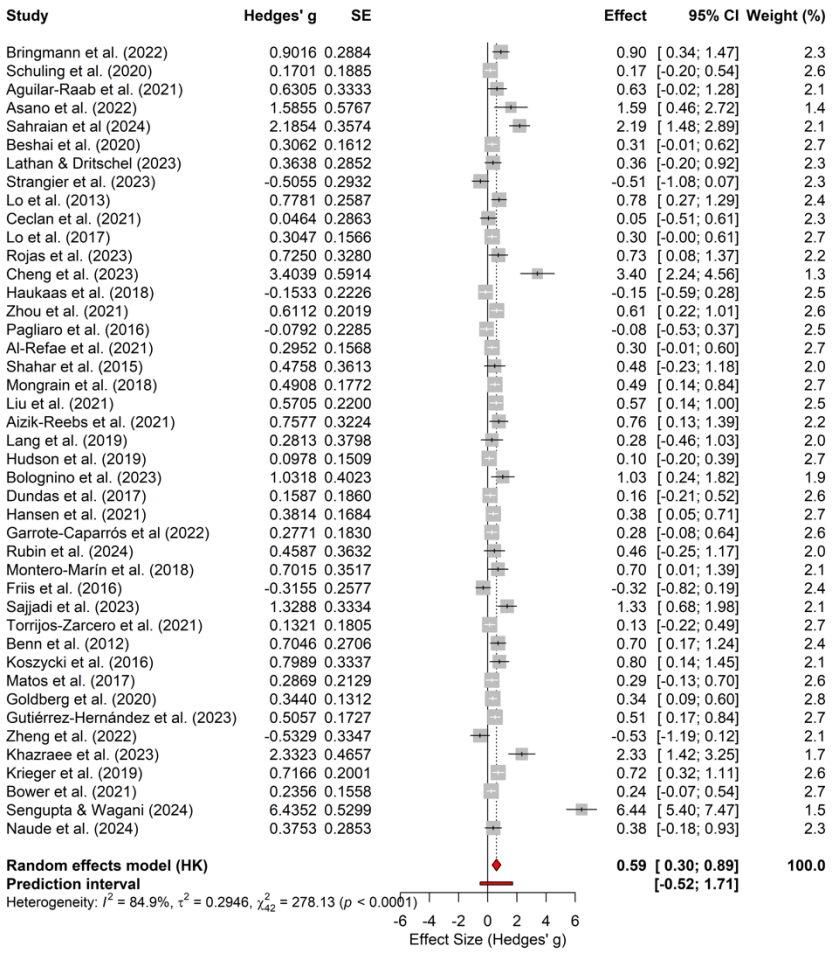

Figure 3: Forest plot for meta-analysis for depressive symptoms.

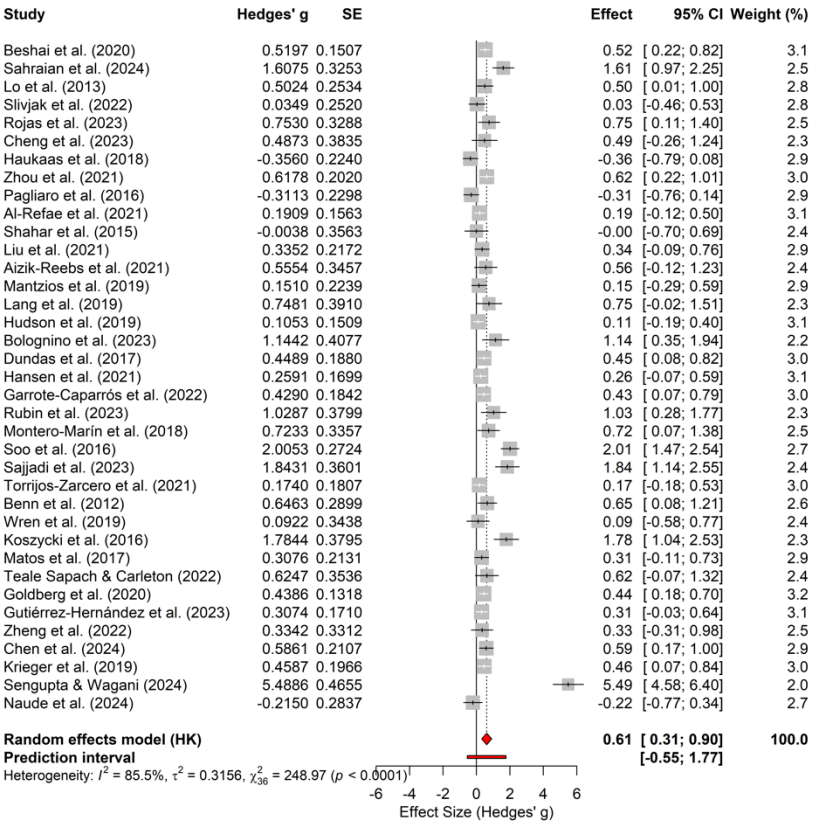

Figure 4: Forest plot for meta-analysis for anxiety symptoms.

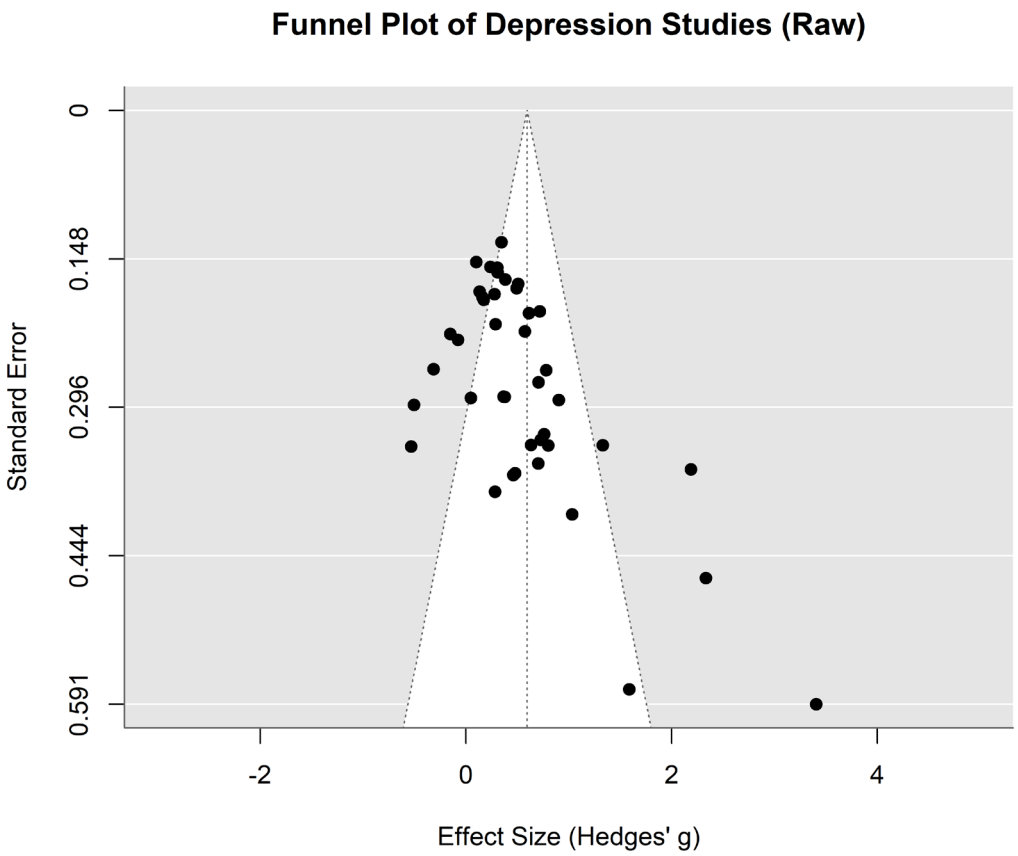

Figure 5: Funnel plot of all included depression studies (k = 43), prior to outlier removal or adjustment.

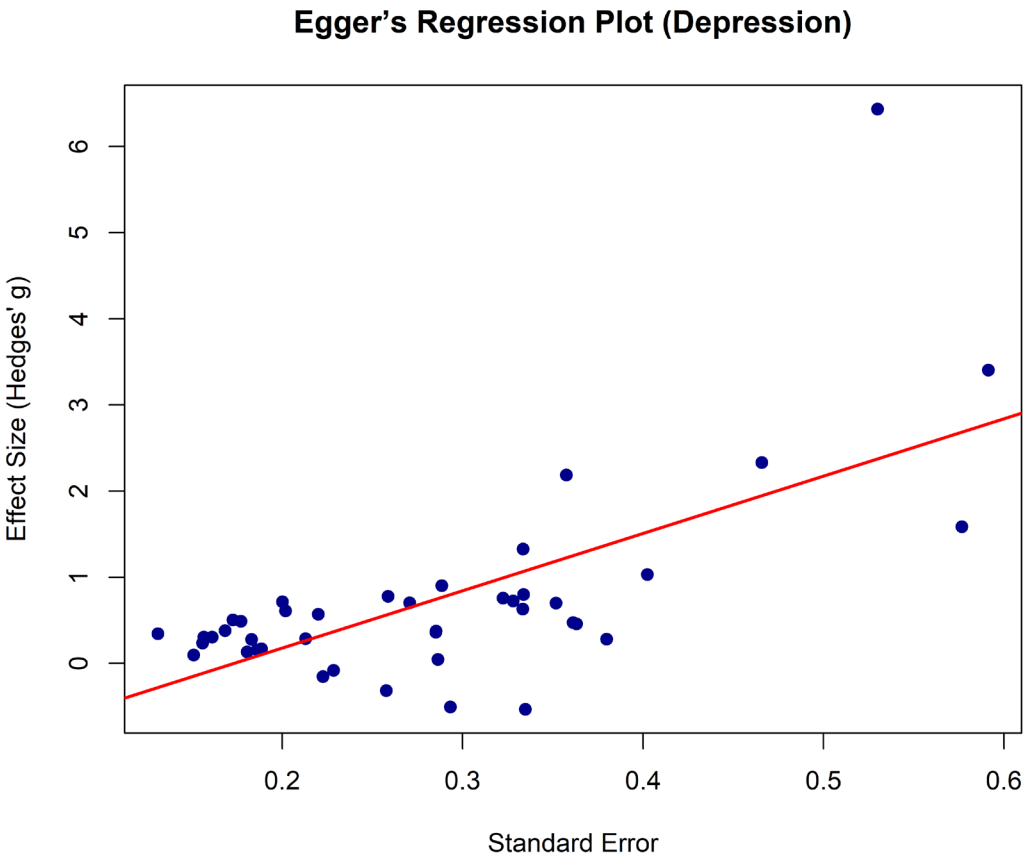

Figure 6: Egger's regression plot for depression studies. Each dot represents an individual study, and the red line indicates the fitted regression line examining the association between effect size (Hedges' g) and standard error.

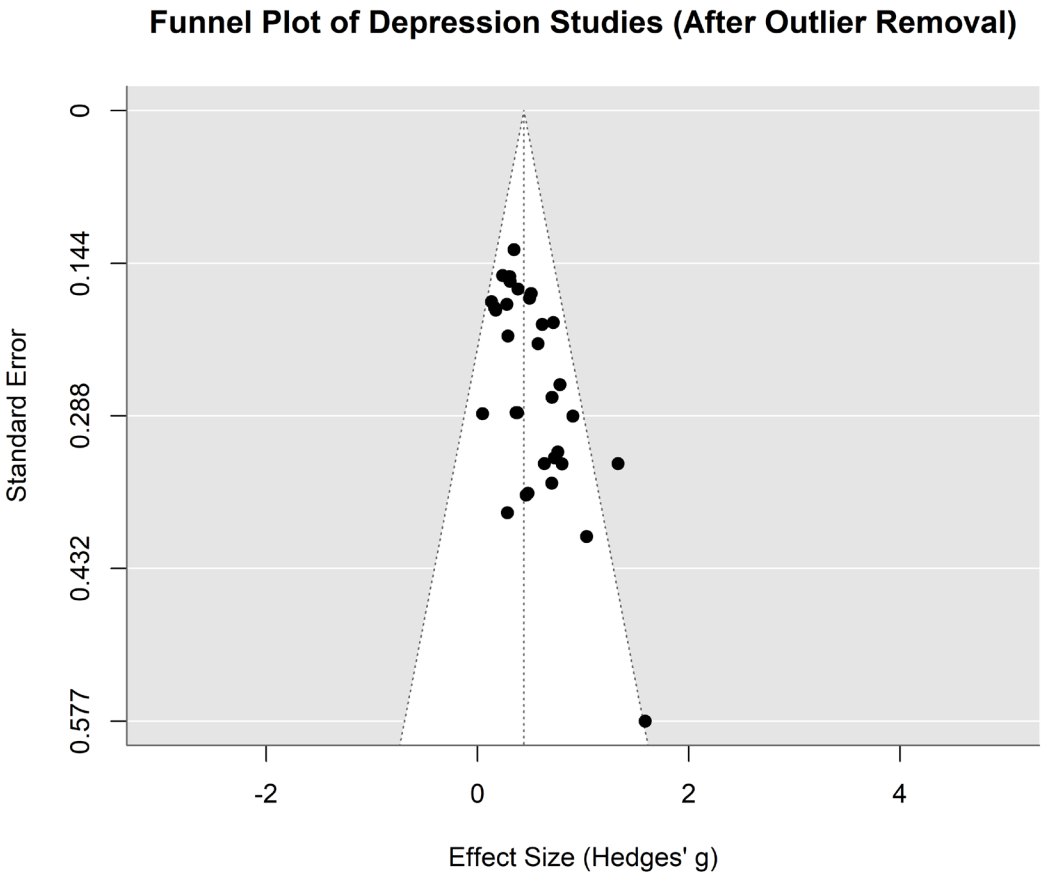

Figure 7: Funnel plot of depression studies after removing ten outlier studies based on confidence interval overlap. Effect size: g = 0.44 (95% CI = [0.35, 0.52]).

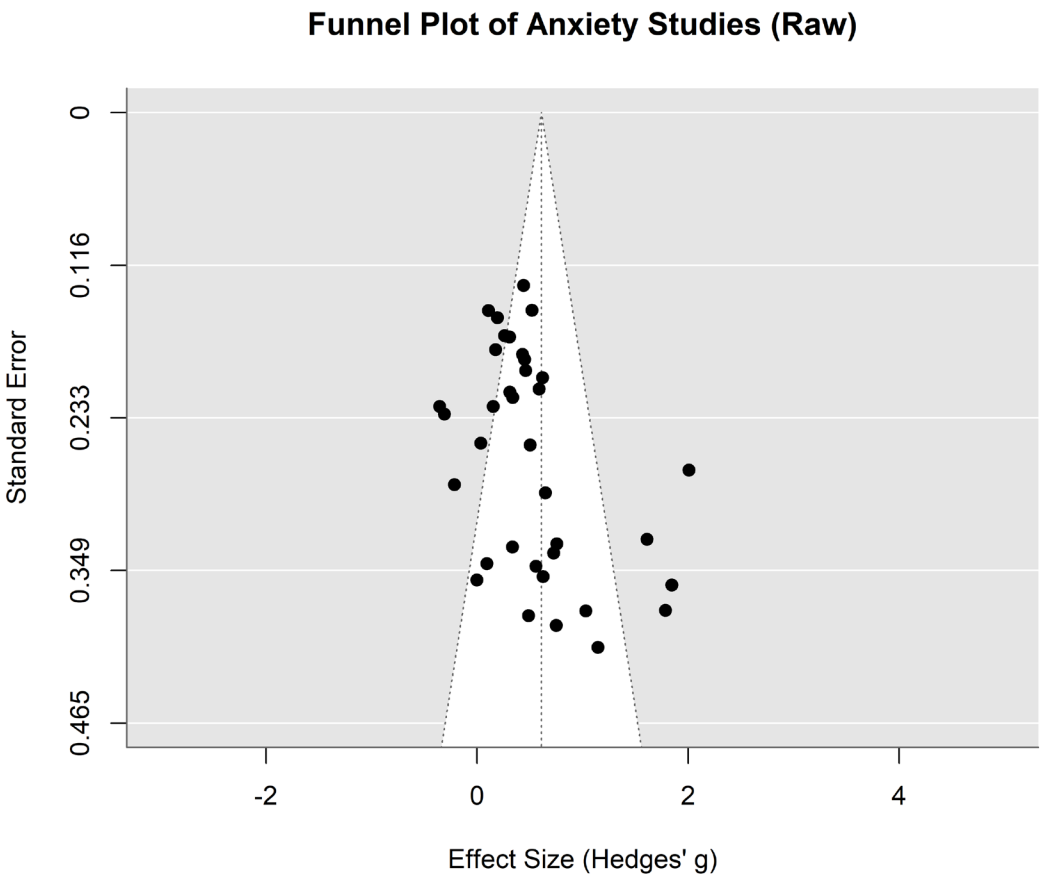

Figure 8: Funnel plot of all included anxiety studies (k = 37), prior to outlier removal or adjustment.

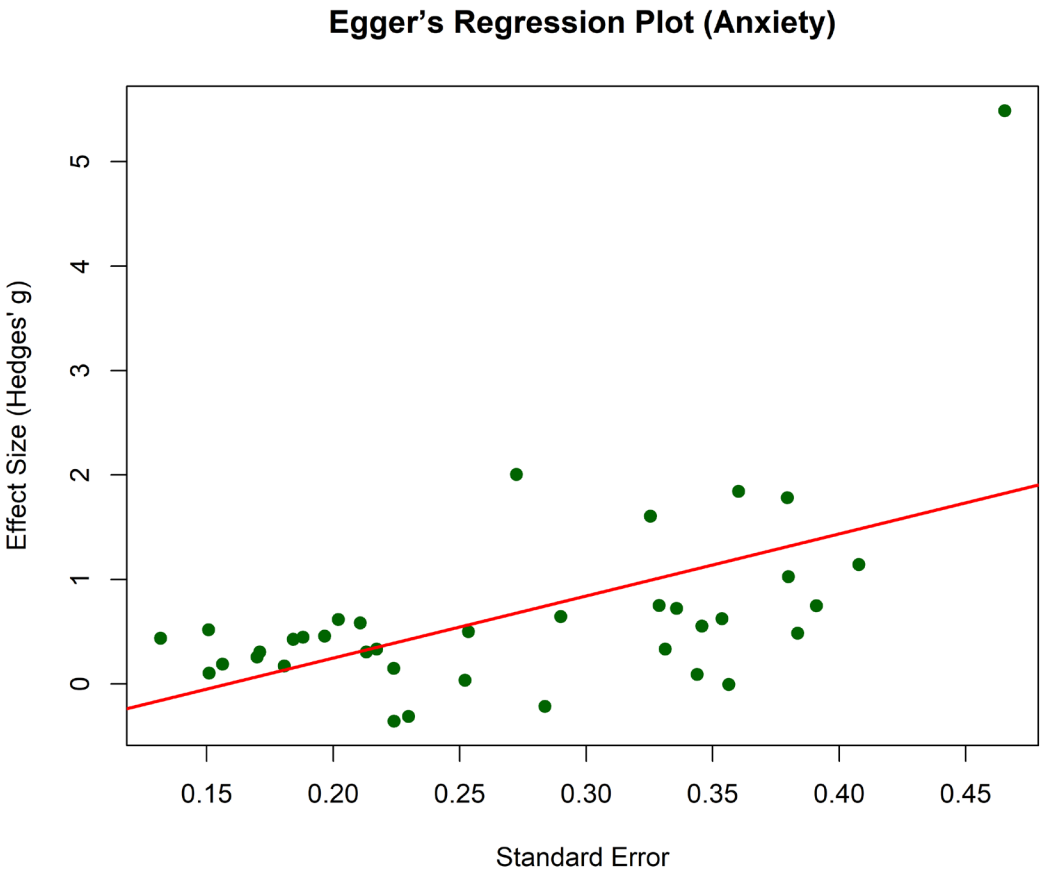

Figure 9: Egger’s regression plot for anxiety studies. Each dot represents an individual study, and the red line indicates the fitted regression line assessing the association between effect size (Hedges’ g) and standard error.

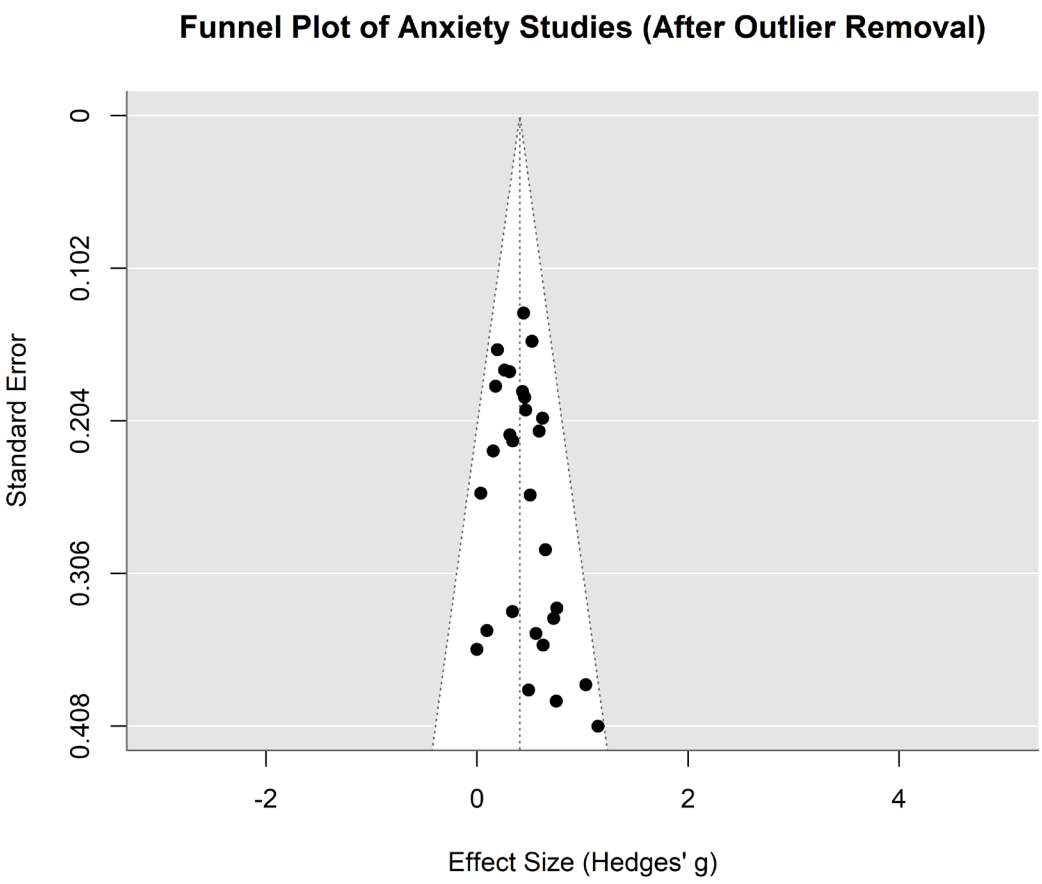

Figure 10: Funnel plot of anxiety studies after removing nine outliers. Final effect size: g = 0.40 (95% CI = [0.32, 0.49]).