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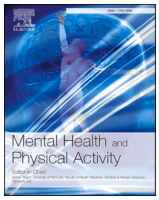

Exploring the effectiveness of digital mind-body exercise interventions on anxiety, depression, stress and quality of life in adults: A systematic review and meta-analysis

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1. Introduction

Physical activity is an umbrella term encompassing any bodily movement that requires energy expenditure, whereas exercise denotes a planned, structured, repetitive subset of physical activity undertaken to improve or maintain fitness and health (WHO, 2012). In this manuscript, we use the term 'exercise' when referring specifically to structured mind-body exercise (MBE) interventions.

Exercise is consistently associated with improvements in mental health outcomes, including reductions in symptoms of anxiety and depression, lower levels of psychological distress, and improved quality of life across diverse adult populations (Gillison et al., 2009; Singh, Metri, et al., 2023). It is therefore increasingly recommended as part of both the prevention and management of mental health conditions (Stubbs et al., 2018).

Although clinical and public health guidance has largely prioritised aerobic and resistance-based exercise (Teasdale et al., 2025), MBE has received comparatively limited attention in formal recommendations despite growing evidence of its potential benefits for mental health and psychological wellbeing (Brinsley et al., 2020; Vergeer et al., 2023).

MBE integrates structured movement with breath regulation and focused attentional awareness. In contemporary health research, it usually includes yoga, tai chi, and qigong, and in some contexts, Pilates, conscious dance, and related holistic movement practices (Dong et al., 2024; Vergeer et al., 2023).

These interventions might improve anxiety, depression, stress, and broader aspects of quality of life and well-being across clinical and non-clinical populations (Brinsley et al., 2025; Dong et al., 2024; Fleming & Herring, 2018; Frazier et al., 2025; Hendriks et al., 2017; Li et al., 2020; Zhu et al., 2021; Zou et al., 2018). Alongside the metabolic and physical health benefits associated with other forms of exercise, MBE may confer distinct mental health benefits through mechanisms related to autonomic regulation, stress reactivity, and interoceptive awareness (Cheshire & Cartwright, 2021; Vancampfort et al., 2021).

Meta-analytic evidence has shown MBE interventions such as yoga, qigong and tai chi to have considerable potential for improving mental health outcomes in people with mental disorders (Brinsley et al., 2020; Vancampfort et al., 2021). Research also suggests that MBE demonstrates comparable or better efficacy than conventional exercise for improving selected mental health outcomes, such as anxiety symptoms (Singh, Metri, et al., 2023), negative symptoms in schizophrenia (Vogel et al., 2019) and symptoms of post-traumatic stress disorder (PTSD) (Yu et al., 2022). However, the evidence base remains heterogeneous across modalities, populations, comparators and outcome measures. For example, a review of in-person martial arts and combat sports reported inconclusive evidence regarding mental health benefits, largely due to

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heterogeneity in study design and outcome measurement (Ciaccioni et al., 2024).

Digital delivery of health care and exercise programmes accelerated during the COVID-19 pandemic (Ukoha et al., 2021). Recent reviews of digitally delivered exercise interventions have reported improvements in depressive symptoms and anxiety across adult populations (Bhundoo et al., 2025; Brinsley et al., 2025; Chen et al., 2024), though these reviews have focused primarily on aerobic exercise, resistance training and multi-behaviour lifestyle programmes, with little attention given to MBE. Whether these benefits extend to mind-body modalities therefore remains unclear.

This uncertainty is important because remote delivery has the potential to overcome barriers to accessing in-person MBE.

Attending in-person classes incurs cost and time burdens that affect adherence (Nagaswami et al., 2024), and participation tends to be concentrated among white, affluent women, leaving ethnic minority and lower socioeconomic status populations underrepresented (Clarke et al., 2015). Digital delivery, whether asynchronous or via live videoconferencing, may offer a more scalable route to participation (James-Palmer et al., 2022; Koomen et al., 2021).

Early evidence suggests this potential is being realised: online MBE interventions report retention and adherence exceeding 75% in some studies, with participants citing convenience and satisfaction with home-based practice, although technical issues and instructors' reduced ability to observe posture, alignment and engagement remain limitations (Gravesande et al., 2023; James-Palmer et al., 2022). Given that MBE already reports adherence comparable to other exercise interventions in mental healthcare settings (Cramer et al., 2016; Vancampfort et al., 2021), and that digital delivery is feasible and acceptable (Gravesande et al., 2023), it is important to establish whether digitally delivered MBE is associated with improvements in mental health outcomes.

This systematic review and meta-analysis therefore aimed to evaluate the effectiveness of digitally delivered MBE interventions on depression, anxiety, stress and quality of life in adults. Mental health extends beyond the presence or absence of symptoms, so quality of life was included to capture broader wellbeing alongside symptom measures.

The review addressed two questions: (i) what are the effects of digitally delivered MBE interventions on symptoms of depression, anxiety, stress and quality of life in adults; and (ii) do effects vary by control condition and delivery mode? Modality-specific differences were planned but could not be examined, as too few studies were available outside yoga-based interventions.

2. Methods

The systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines (Page et al., 2021). The review protocol was registered with PROSPERO (CRD42024523989). A completed PRISMA checklist is available in Supplementary Material 1.

3. Search strategy

We searched Cochrane Central Register of Controlled Trials Health Technology Assessment; Allied and Complementary Medicine (AMED); APA PsycInfo; Embase; and MEDLINE(R) in March, 2024 and also searched reference lists and conducted a supplementary Google Scholar search (see Supplementary Material 2). Search terms combined MBE modalities, digital delivery, mental-health-related outcomes and randomised trials design. Clinical status did not restrict eligibility. However, because the search strategy prioritised mental-health-related indexing terms, some relevant trials in broader adult populations may have been missed if they were not indexed using mental-health-related terminology.

3.1. Eligibility criteria

Eligible studies were randomised controlled trials in adults aged 18 years or older that evaluated a digitally delivered MBE intervention against an active or inactive comparator and reported at least one eligible outcome: depression, anxiety, stress, or quality of life. We defined digital delivery as completely or primarily online delivery, including websites, apps, and videoconferencing platforms. Studies with minor adjunctive telephone or email support remained eligible if the principal intervention was delivered online.

This approach reflects contemporary transdiagnostic models, which suggest that depression and anxiety share overlapping internalising and negative affect dimensions while recognising meaningful differences in phenomenology and functional impact (Clark & Watson, 1991; Krueger & Eaton, 2015). Stress was included as a related indicator of emotional distress and stress regulation. Quality of life was included because it reflects broader aspects of functioning and subjective wellbeing beyond the severity of clinical symptoms, including physical, psychological, social and environmental domains. Recent reviews suggest that physical activity may improve mental health partly through affective and psychosocial pathways, while mind-body interventions may also additionally operate through mechanisms linked to interoceptive awareness and emotion regulation (Lazzarelli et al., 2024).

English-language articles published in peer-reviewed journals were eligible, with no restriction on publication date.

3.2. Study selection

Two reviewers (HF and LS) independently screened titles, abstracts. The same reviewers independently assessed all full-text articles that met the inclusion criteria. Interrater agreement was 76%. Disagreements were resolved through discussion with a third reviewer (CS).

3.3. Data extraction

Three reviewers (HF, JB, CF) independently extracted data using a piloted extraction tool. The following information was collected for each study:

i) Participant characteristics: sample size (*n*), sex (% females), mean age of participants (years) and the health status of the population (diagnostic information or relevant inclusion criteria)
ii) Digital mind-body intervention: intervention lengths (weeks), type of MBE, digital delivery modality, details of the intervention and details of the control condition (e.g. active comparator, treatment as usual, waitlist)
iii) Effects on depression, anxiety, stress and quality of life: changes in outcome measure pre-to post-intervention for both the intervention and control groups.

3.4. Meta-analysis

Statistical analyses were conducted using Review Manager (RevMan) Version 5.3 and Stata Version 19. The proportion of missing outcome data for each included study is reported in Supplementary Material 3. For each trial, effect sizes were calculated by comparing changes in outcomes from baseline to post-intervention in the MBE group with the corresponding change in the control group. Standard mean differences (SMDs) were calculated using Cohen's d to allow pooling the results from different outcome measures (Andrade, 2020). For multi-arm studies analysed as separate conditions, the shared control group sample size was divided equally across the relevant intervention arms. Additionally, when a study included more than one control group, data from the control groups were pooled into a single comparator.

One study (Ahmad et al., 2022) reported only an F-statistic, p-value, and sample size. To be included in the meta-analysis, the F value was

converted to a *t* statistic and Cohen's d was then derived from the t value and group sample sizes (Borenstein et al., 2021). Effect sizes for 20 additional studies (Acar et al., 2023; Baklouti et al., 2023; Balmumcu & Ozturk, 2023; Bennell et al., 2022; Bhandari, 2022; Brandão et al., 2024; Bulguroglu & Bulguroglu, 2023; Chang et al., 2022; De Araujo et al., 2023; D'Silva et al., 2023; Gao et al., 2022; Harrison et al., 2024; Huberty et al., 2019; Kim & Hyun, 2022; Liang et al., 2022; Najafi et al., 2023; Pandya, 2021; Sari et al., 2024; Singh, Metri, et al., 2023; Wadhen & Cartwright, 2021) were derived from pre-intervention and post intervention means and standard deviations (Borenstein et al., 2021). Random-effects models were used throughout to account for between-study heterogeneity.

Between-study variance was estimated using the Restricted Maximum-Likelihood method (Tau^2), and the I^2 statistic was used to quantify heterogeneity. Publication bias was assessed using Egger's regression test. In addition, Duval and Tweedie's trim-and-fill method was also conducted to adjust for potential publication bias and estimate the adjusted effect sizes. The following cutoff values for the I^2 statistic were used: 0%-29% = no heterogeneity, 30%-49% = moderate heterogeneity, 50%-74% = substantial heterogeneity, and 75%-100% = considerable heterogeneity (Jakobsen et al., 2014).

Pre-specified subgroup analyses compared intervention effects by type of control condition (inactive vs. active), digital delivery modality, and sample demographics (e.g., age, gender). For subgroup analyses by delivery mode, any intervention that included any live, instructor-led sessions was classified as synchronous, even if additional recorded or app-based materials were also provided. One hybrid intervention delivered through Whatsapp (Ahmad et al., 2022) was not included in the subgroup analysis for delivery mode. Sensitivity analyses excluded studies with a high risk of bias.

3.5. Risk of bias

Two reviewers (HF, CF) independently conducted the quality appraisal of each study using the Cochrane Collaboration Risk Of Bias (ROB) Tool Version 2. Each study was rated as having either 'low risk', 'some concerns' or 'high risk' (Higgins et al., 2019).

3.6. Confidence in cumulative estimate

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework was applied to assess the publication bias, precision, and consistency for each outcome included in the meta-analysis (Guyatt et al., 2011). Overall GRADE quality was rated from

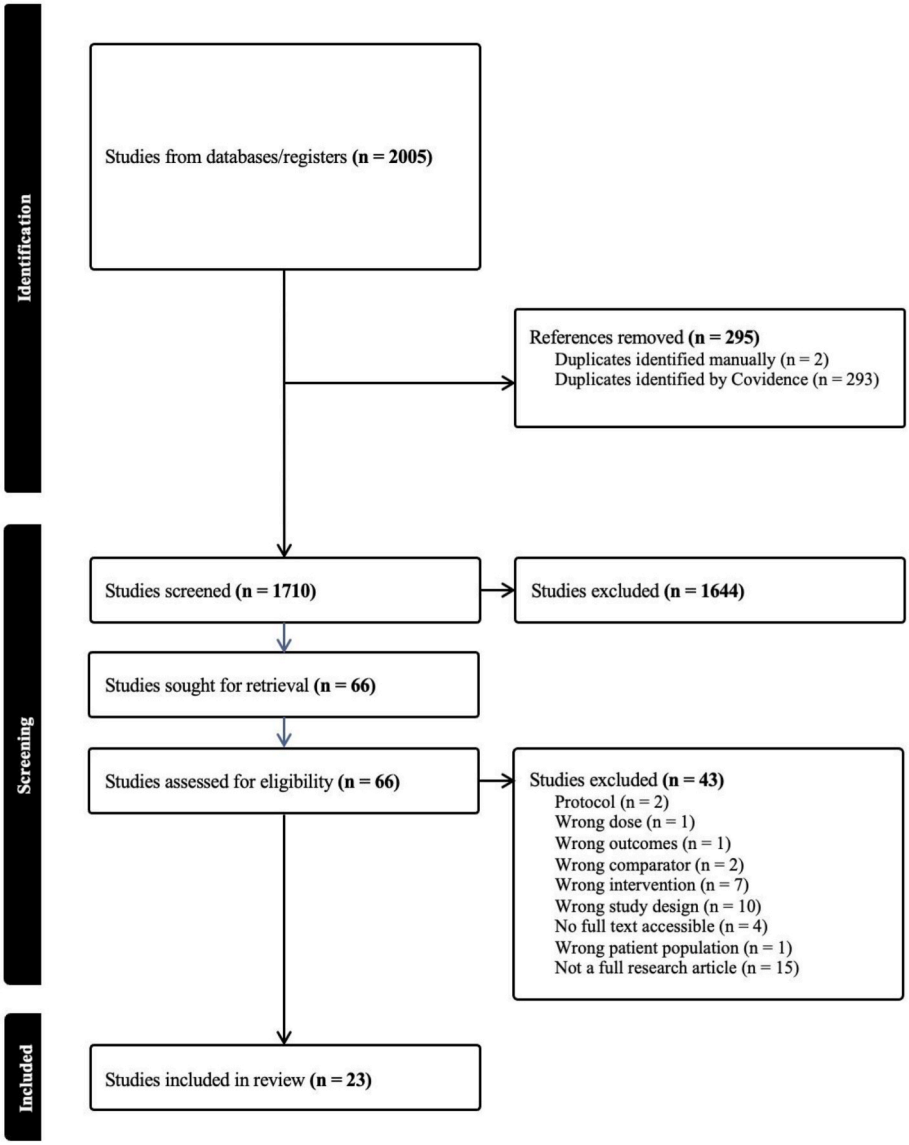

Fig. 1. PRISMA 2020 Flowchart of study selection.

low to high certainty, rating confidence in the true effect being similar to the estimated effect.

4. Results

The database search conducted on 18 March 2024 returned 2005 results, which were reduced to 1710 unique citations after removing duplicates. Fig. 1 outlines the study selection process using a PRISMA 2020 flowchart. Following title and abstract screening, 1644 records were excluded and 66 articles were assessed for eligibility. Twenty-three studies met the inclusion criteria and were included in the review. Reasons for full-text exclusion are presented in Supplementary Material 4.

4.1. Risk of bias

Fig. 2 shows the ROB assessments for all included studies. Eight studies had a high ROB, while the remaining 15 showed some concerns.

4.2. Confidence in cumulative estimate

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework was used to assess the certainty of evidence for each outcome (Supplementary Material 5). The certainty of evidence was rated as low for depression, stress and quality of life, and very low for anxiety.

4.3. Study and sample characteristics

Table 1 summarises the characteristics of the included studies. The 23 included trials contributed outcome data for 2586 participants. The trials were conducted in a variety of countries: four in Turkey (Acar et al., 2023; Balmumcu & Ozturk, 2023; Bulguroglu & Bulguroglu, 2023; Sari et al., 2024), three in the United States of America (USA) (Chang et al., 2022; Gao et al., 2022; Huberty et al., 2019), three in India (Bhandari, 2022; Nadholta et al., 2023; Singh, Metri, et al., 2023), two each in Brazil (De Araujo et al., 2023; Harrison et al., 2024), Canada (Singh, Metri, et al., 2023; Puterman et al., 2022), and the UK (Liang

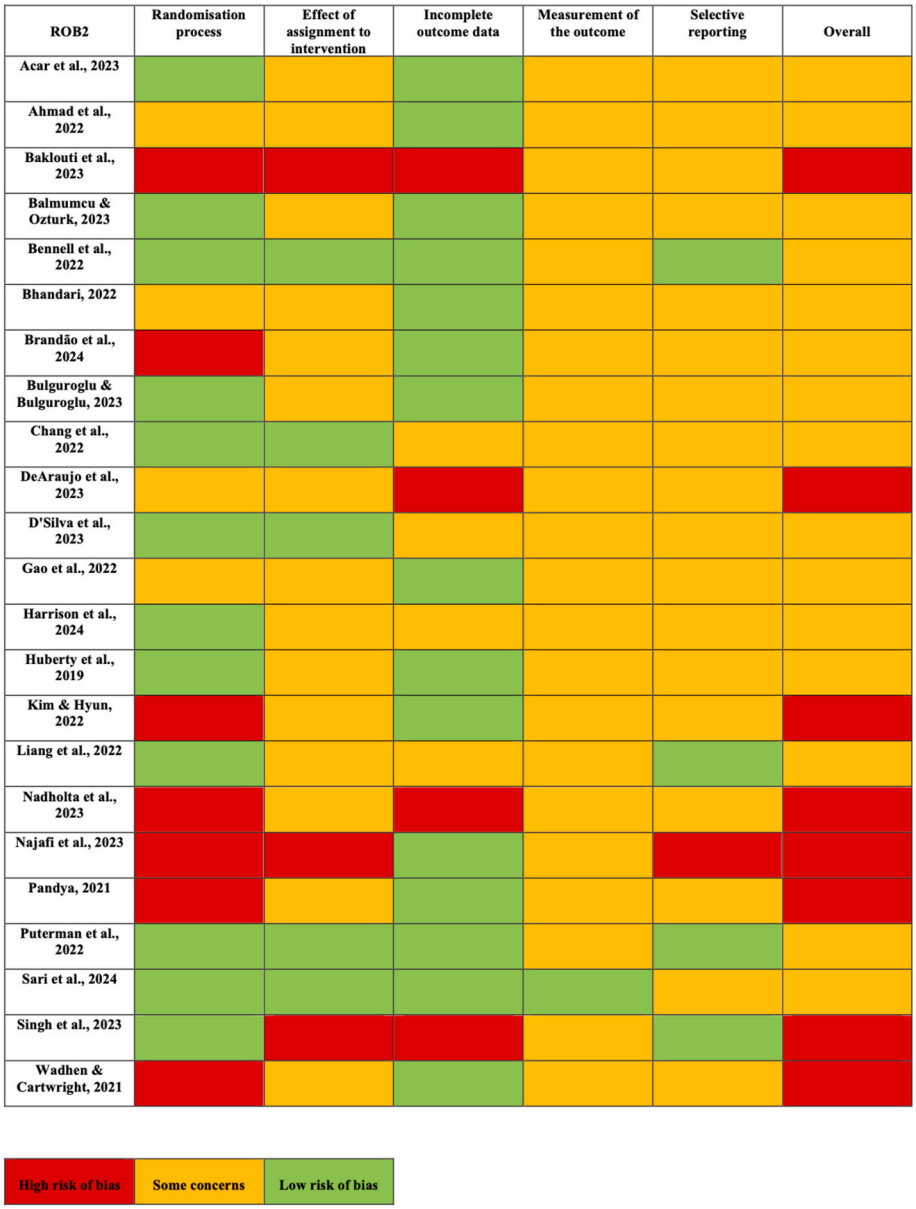

Fig. 2. Revised tool for risk of bias in randomised trials.

Table 1
Study characteristics.

Author, Year	Country	Target sample, sample size, gender (% female)	Age, years (mean, SD)	Study Aims	Type of MBE	Digital modality	Intervention's duration and frequency	Control condition	Relevant outcomes	Measures/ Instruments
Acar et al. (2023)	Turkey	Ankylosing Spondylitis patients. IG: n = 28 CG: n = 27 Overall: 45%	IG: 44.14 (8.03) CG: 45.33 (7.24)	Examining the effect of tele-yoga on physical function, disease activity, spinal mobility, flexibility, muscle endurance, exercise capacity, balance, sleep quality, stress, depression, anxiety, quality of life and mindfulness in patients with ankylosing spondylitis	Yoga	Zoom	60-min sessions 3 sessions a week, for 8 weeks 24 sessions in total	No intervention	Anxiety Depression Stress Quality of life	HADS PSS SF-36
Ahmad et al. (2022)	Nigeria	Nigerian evacuees from Ukraine as a result of Russia-Ukraine war. IG: n = 154 (60%) CG: n = 153 (45%)	IG: 27 CG: 26	Assessing the impact of social media-based dance therapy on depressive symptoms in victims of the war in Ukraine	Dance therapy	WhatsApp	60-min sessions 4 sessions a week, for 3 weeks 12 sessions in total	No intervention	Depression	Zung's Self-rating Depression Scale
Baklouti et al. (2023)	Tunisia	Older adults (≥65 years). IG: n = 65 CG: n = 95 Overall: 38.75%	Aged 65-75yrs: 120 participants Aged 76-85 yrs: 40 participants	Using a web-based Hatha yoga program to improve depression, anxiety, stress and sleep quality in older adults who self-isolated during COVID-19. Assessing the preventive effects of this intervention against future mental health difficulties.	Yoga	Google Meet	80-min sessions 2 sessions a week, for 8 weeks 16 sessions in total	No intervention	Anxiety Depression Stress	DASS-21
Balmumcu and Ozturk (2023)	Turkey	Female students with PMS. IG: n = 30 CG: n = 29 Overall: 100%	IG: 20 (2.27) CG: 20.1 (2.35)	Investigating the effect a WhatsApp-based Pilates program on reducing PMS symptoms on female college students	Pilates	Online exercise sessions	60-min sessions 2 sessions a week, for 8 weeks 16 sessions in total	No intervention	Anxiety Depression	PMSS
Bennell et al. (2022)	Australia	Knee osteoarthritis patients. IG: n = 107 CG: n = 105 Overall: 69.80%	IG: 61.8 (7.2) CG: 62.8 (8.2)	Evaluating the effect of an unsupervised online yoga program together with an online education website in patients with knee osteoarthritis	Yoga + Education	*Yoga:* Unsupervised videos on website. *Education:* access to downloadable website content.	*Yoga:* 30-min sessions 3 sessions a week, for 12 weeks 36 sessions in total *Education:* accessible as many times as wished.	Access to a customised website containing downloadable educational material	Anxiety Depression Stress Quality of life	DASS-21 AQoL-6D
Bhandari (2022)	India	Symptomatic COVID-19 survivors. IG: n = 24 CG: n = 48 Overall: 36%	IG-YG: males 29.7 (6.2), females 34.1 (15.1) IG-YCG: males 31.7 (11.3), females 34 (11.8) CG: males 34.4 (11), females 28.6 (12)	Assessing the impact of an online Yoga intervention and an online Yoga Ayurveda intervention on COVID-19 induced depression, anxiety, PTSD and poor QoL	Yoga Yoga-Ayurveda	Zoom	90-min sessions 5 sessions a week, for 4 weeks 20 sessions in total	No intervention	Anxiety Depression	HAM-A BDI
Brandão et al. (2024)	Portugal	University students. IG: n = 28 CG: n = 34 Overall: 91%	All: 21.04 (4.59) IG: 21.46 (5.7) CG1: 21.35 (4.64) CG2: 20.52 (3.75)	Examining the efficacy of an online Kundalini Yoga intervention on depression, anxiety stress and levels of self-compassion of college students	Yoga	Zoom	60-min sessions 1 session a week, for 6 weeks 6 sessions in total	*Active:* autogenic training (meditation/ mindfulness). *Passive:* no intervention	Anxiety Depression Stress	DASS-21
Bulguroglu and Bulguroglu (2023)	Turkey	Healthy individuals. IG: n = 20	IG: 28 (IQR 25-31) CG face-to-	Analysing the effect of an online Pilates program on core muscle	Pilates	Microsoft Teams	60-min sessions 3 sessions a week, for 8	*Active:* face to face Pilates *Passive:* relaxation and	Depression Quality of life*	BDI SF-36

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Table 1 (*continued*)

Author, Year	Country	Target sample, sample size, gender (% female)	Age, years (mean, SD)	Study Aims	Type of MBE	Digital modality	Intervention's duration and frequency	Control condition	Relevant outcomes	Measures/ Instruments
		CG face-to-face: n = 18 CG: n = 20	face: 29 (IQR 26-33) CG: 27 (IQR 24-32)	endurance, depression and QoL in healthy individuals			weeks 24 sessions in total	breathing exercises at home		
Chang et al. (2022)	USA	Undergraduate students. IG: n = 326 CG: n = 352 Overall: 71.60%	IG: 21.4 (4.7) CG: 21.3 (5.0) Total: 21.3 (4.8)	Evaluating the effect of a brief online Yoga routine on mental health and well-being of college students	Yoga	Videos on website	1 session consisted of 3 cycles of Yoga Namaskar and 4 min of Nadi Shuddhi 1 daily session, for 12 weeks 84 sessions in total	Wait-list for 4 weeks, told to complete same practice as intervention group for the remaining for 8 weeks	Anxiety Depression Stress	PHQ-4 PSS-10
De Araujo et al. (2023)	Brazil	Family members of people with Alzheimer's Disease. IG: n = 25 CG: n = 24 Overall: 100%	IG: 54.96 (9.36) CG: 53.54 (8.84)	Assessing the effectiveness of an online psychoeducation program integrated with online yoga on the quality of life of people with Alzheimer's Disease	Yoga + Psychoeducation	Google Meet WhatsApp	*Psychoeducation:* 30-min meetings 1 meeting a week, for 8 weeks 8 meetings in total *Yoga:* 30-min Yoga sessions applied after every education meeting, also once a week for 8 weeks	*Psychoeducation:* 30-min meetings 1 meeting a week, for 8 weeks 8 meetings in total	Anxiety Depression Stress Quality of life	DASS-21 CQOL-AD
D'Silva et al. (2023)	Canada	Irritable Bowel Syndrome patients. IG: n = 27 CG: n = 36 Overall: 92.40%	Total: 45.37 (14.0) IG: 43.50 (12.90) CG: 47.10 (14.80)	Examining the efficacy and feasibility of an online yoga program on irritable bowel syndrome symptom severity, quality of life, mental health, stress, fatigue and self-compassion	Yoga	Microsoft Teams	*Supervised Yoga:* 60-min sessions 1 session a week, for 8 weeks 8 sessions in total *Unsupervised:* Daily sessions supported by Yoga videos	Access to online advice-only video content	Anxiety Depression Stress Quality of life	GAD-7 PHQ-9 PSS IBS-QOL
Gao et al. (2022)	USA	Breast cancer survivors. IG: n = 20 CG: n = 15 Overall: 100%	IG: 56.85 (9.79) CG: 55.27 (11.47)	Evaluating the effectiveness of a mobile Tai Chi app on stress and quality of life of breast cancer survivors	Tai Chi	App (7 Minute Chi app)	7-min sessions 3 sessions a day, for a minimum of 5 days a week, for 12 weeks Minimum of 180 sessions in total	Received Facebook health education tips and asked not to practice Tai Chi for the 12-weeks program	Stress Quality of life	PSS-10 PROMIS
Harrison et al. (2024)	Brazil	Older adult women (≥55 years). IG: n = 21 CG: n = 23 Overall: 100%	IG: 67.81 (7.3) CG: 69.96 (6.7)	Using online ballet classes to improve functional mobility, quality of life and mood of older women (≥55)	Ballet	Zoom	45-min sessions 2 sessions a week, for 12 weeks 24 sessions in total	*Wellness classes:* Discussions on topics related to wellness and ageing, with no movement or exercise.	Depression Quality of life*	GDS SF-36
Huberty et al. (2019)	USA	Myeloproliferative Neoplasm patients. IG: n = 27 CG: n = 21 Overall: 93.80%	IG: 58.3 (9.3) CG: 55.0 (11.4) All: 56.9 (10.3)	Examining the limited efficacy of an online yoga program on symptom burden and quality of life of patients with Myeloproliferative Neoplasm	Yoga	Videos on website (Udaya)	60-min sessions 1 session a week, for 12 weeks 12 sessions in total	Wait-list	Anxiety Depression Quality of life	NIH PROMIS
Kim and Hyun (2022)	Korea	Pregnant women (24-28 weeks pregnant). IG: n = 8 CG: n = 8 Overall: 100%	IG: 39.71 (2.01) CG: 38.14 (1.39)	Investigating the effects of an online Pilates program on body composition, blood lipids, postpartum depression, sleep disorders, perceived stress, and serotonin after childbirth of pregnant women	Pilates	Zoom	50-min sessions 2 sessions a week, for 8 weeks 16 sessions in total	No intervention and no exercise	Depression Stress	EPDS PSS-10
Liang et al. (2022)	UK	Inactive older adults. IG: n = 13 CG: n = 16 Overall: 57.60%	IG: 72.6 (5.0) CG: 71.9 (4.7)	Examining the feasibility and acceptability of home-based online exercise programs and exploring its effects on physical function and well-being in older adults who self-isolated during the COVID-19 pandemic	Tai chi snacking	Video instructions on movements	1 session consisted of 5 Chen style tai chi movements, each undertaken for 1 min, then resting 1 min between exercises. 2 daily sessions,	Provided with link to NHS web page "Physical activity guidelines for older adults"	Anxiety Depression	BAI BDI

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Table 1 (*continued*)

Author, Year	Country	Target sample, sample size, gender (% female)	Age, years (mean, SD)	Study Aims	Type of MBE	Digital modality	Intervention's duration and frequency	Control condition	Relevant outcomes	Measures/ Instruments
							for 28 weeks 56 sessions in total			
Nadholta et al. (2023)	India	Pregnant women (2nd or 3rd trimester). IG: n = 34 CG: n = 43 Overall: 100%	IG: 29.31 (SEM 3.415) CG: 29.71 (SEM 3.00)	Assessing the impact of an online Yoga intervention on the psychological distress and quality of life of women with an uncomplicated pregnancy	Yoga	Google Meet	40 to 60-min sessions 5 sessions a week, for 47.18 ± 2.03 weeks,	No physical activity other than walking	Anxiety Depression Stress Quality of life	DASS-42 PSS-10 WHO-QOL-BREF
Najafi et al. (2023)	Iran	Women with Multiple Sclerosis. IG: n = 15 CG: n = 15 Overall: 100%	IG Pilates: 36.20 (4.33) IG Yoga: 37.40 (6.03) CG: 38.00 (5.46)	Evaluating the effects of two online programs (tele-Pilates and tele-yoga) on depression, mental health, quality of life, physical activity level and walking speed in females with Multiple Sclerosis	Yoga Pilates	Google Meet Zoom Instagram	50-min to 70-min sessions 3 sessions a week, for 8 weeks 24 sessions in total	No intervention	Quality of life	MSQoL-54
Pandya (2021)	India/ South Africa	Older adult women. IG: n = 74 CG: n = 56 Overall: 100%	IG: 68.01 (2.32) CG: 67.93 (2.51)	Examining the impact of an online yoga program on anxiety, resilience, salutogenic wellness and well-being in older women during the COVID-19 pandemic	Yoga	Zoom	30-min sessions 1 daily session, for 30 days 30 sessions in total	Wait-list	Anxiety	GAS-10
Puterman et al. (2022)	Canada	Low active adults. IG HIIT: n = 82 IG Yoga: n = 86 IG HIIT and Yoga: n = 83 CG: n = 83 Overall: 83%	IG Yoga: 37.8 (12.3) All: 40.3 (12.4)	Investigating the effects of an online yoga program on depressive symptoms in general population during the COVID-19 pandemic	Yoga	DownDog App	20-min sessions 4 sessions a week, for 6 weeks 24 sessions in total	Wait-list	Depression	CES-D
Sari et al. (2024)	Turkey	Systemic sclerosis patients. IG: n = 24 CG: n = 22 Overall: 97.83%	IG: 42.46 (14.99) CG: 41.96 (10.62)	Assessing the effects of an online Pilates-based exercise program on disability level, pain, fatigue, physical activity, anxiety, depression, quality of life and sleep in patients with systemic sclerosis	Pilates	YouTube	10-min sessions 2 daily sessions, for 8 weeks 18 sessions in total	Brochure of Pilates exercises via WhatsApp	Anxiety Depression Quality of life	HADS NHP
Singh, Metri, et al. (2023)	India	Ankylosing spondylitis patients. IG: n = 57 CG: n = 52 Overall: 17%	All: 34.74 (9.57) IG: 34.42 (9.39) CG: 35.09 (9.86)	Analysing the effect of an online yoga intervention on disease activity, functional index, inflammatory markers, quality of life and mental health measures in patients with Ankylosing Spondylitis during the COVID-19 pandemic	Yoga	Online exercise sessions	60-min sessions 2 sessions a week, for 12 weeks	TAU	Anxiety Depression Quality of life	PHQ-4 AS-QoL
Wadhen and Cartwright (2021)	UK	Healthy adults working from home. IG: n = 17 CG: n = 17 Overall: 91%	IG: 42.7 (10.94) CG: 42.2 (10.20)	Investigating the feasibility and acceptability of an online yoga program and its effects on stress and mental wellbeing of general population working from home during the COVID-19 pandemic	Yoga	Zoom	50-min sessions 2 to 3 sessions a week, for 6 weeks 12 to 18 sessions in total	Wait-list Asked not to practice yoga during the 6 weeks program	Anxiety Depression Stress	DASS-21 PSS-14

Note. MBE = **Mi**nd-Body Exercise, **IG** = Intervention Group, **CG** = Control Group. **TAU** = Treatment as Usual. * Although Bulguroglu et al., 2023 measure quality of life, this was not included in the meta-analysis as a total score for quality of life was not reported. **HADS** = Hospital Anxiety and Depression Scale, **PSS** = Perceived Stress Scale, **SF-36** = 36-Item Short Form Health Survey, **DASS-21** = Depression Anxiety Stress Scale-21, **PMSS** = Premenstrual Syndrome Scale, **AQoL-6D** = Assessment of Quality of Life, **HAM-A** = Hamilton Anxiety Rating Scale, **BDI** = Beck Depression Inventory, **WHO-QOL-BREF** = World Health Organisation Quality of Life questionnaire, **PHQ-4** = Patient Health Questionnaire 4 Item Version, **CQOL-AD** = Alzheimer's Disease Quality of Life Scale, **GAD-7** = Generalized Anxiety Disorder-7, **PHQ-9** = Patient Health Questionnaire 9 Item Version, **IBS-QOL** = Irritable Bowel Syndrome Quality of Life, **PROMIS** = Patient Reported Outcome Measurement Information System, **GDS** = Geriatric Depression Scale, **EPDS** = Edinburgh Postnatal Depression Scale, **BAI** = Beck Anxiety Inventory, **DASS-42** = Depression Anxiety Stress Scale-42, **MS-QoL-54** = Multiple Sclerosis Quality of Life-54, **GAS-10** = Geriatric Anxiety Scale-10, **CES-D** = Center for Epidemiological Studies Depression Scale, **NHP** = Nottingham Health Profile, **AS-QoL** = Ankylosing Spondylitis Quality of Life.

et al., 2022; Wadhen & Cartwright, 2021), and one each in Australia (Bennell et al., 2022), Iran (Najafi et al., 2023), South Korea (Kim & Hyun, 2022), Portugal (Brandão et al., 2024), Tunisia (Baklouti et al., 2023) and Nigeria (Ahmad et al., 2022). One study was conducted jointly in India and South Africa (Pandya, 2021). The study sample size ranged from 16 to 678 participants. The mean age of participants was 43.4 years (range 20 - 85 years), and 79% of participants were female.

The included populations were heterogeneous. Four studies involved healthy adults (Brandão et al., 2024; Bulguroglu & Bulguroglu, 2023; Chang et al., 2022; Wadhen & Cartwright, 2021). One study targeted low-active (i.e., engaged in less than 150 min of moderate intensity exercise a week) adults (Puterman et al., 2022). Two studies included older women only (aged 55+) (Harrison et al., 2024; Pandya, 2021), one study included older adult men and women (aged 65+) (Baklouti et al., 2023), and another focused on inactive (not engaging in regular exercise) older adults (Liang et al., 2022). Two studies were conducted with pregnant women (Kim & Hyun, 2022; Nadholta et al., 2023), and two involved patients with ankylosing spondylitis (a form of arthritis affecting the spine) (Acar et al., 2023). Two studies were conducted with patients with autoimmune diseases: one with women with multiple sclerosis (Najafi et al., 2023) and one with patients (both male and female) with systemic sclerosis (Sari et al., 2024). The remaining studies involved patients with a myeloproliferative neoplasm (Huberty et al., 2019), breast cancer survivors (Gao et al., 2022), family caregivers of people with Alzheimer's disease (De Araujo et al., 2023), patients with irritable bowel syndrome (IBS) (D'Silva A. et al., 2023), symptomatic COVID-19 survivors (Bhandari, 2022), patients with knee osteoarthritis (Bennell et al., 2022), students with premenstrual symptoms (Balmumcu & Ozturk, 2023) and Nigerian war evacuees (Ahmad et al., 2022).

Most interventions evaluated yoga ($n = 14$). The remaining studies examined Pilates ($n = 4$), tai chi ($n = 2$), dance ($n = 1$) and ballet ($n = 1$), with only one study including both yoga and Pilates. Fifteen studies delivered the intervention via live video conferencing platforms (e.g., Zoom, Google Meet) and seven used pre-recorded instructional videos (e.g., YouTube, yoga applications); one used a hybrid WhatsApp-based approach to deliver a combination of live and recorded sessions. Mean session duration was 46 min (range 7–90), mean frequency was five sessions per week (range 1–15), and mean intervention duration was nine weeks (range 3–28).

Twenty-one studies assessed depressive symptoms, 16 assessed anxiety, 11 assessed stress and 13 assessed quality of life. Not all studies contributed to each meta-analysis.

4.4. Overall effects of digital MBE interventions on symptoms of depression

Twenty studies contributed to the meta-analysis of depressive symptoms. Pooled effect sizes from these studies indicated that digitally delivered MBE interventions significantly decreased symptoms of depression compared to control conditions ($n = 2119$, d = - 0.53, 95% CI (−0.78, −0.27), $p < 0.001$; see Fig. 3). Heterogeneity was high ($I^2 = 85\%$). Egger's regression test for small study effects was not significant ($\beta_1 = -1.05$, SE = 1.15; z = −0.91; p = 0.36). A trim-and-fill analysis using a random-effects model indicated that the effect size was unchanged after accounting for publication bias (adjusted d = −0.53, 95% CI −0.76 to −0.28).

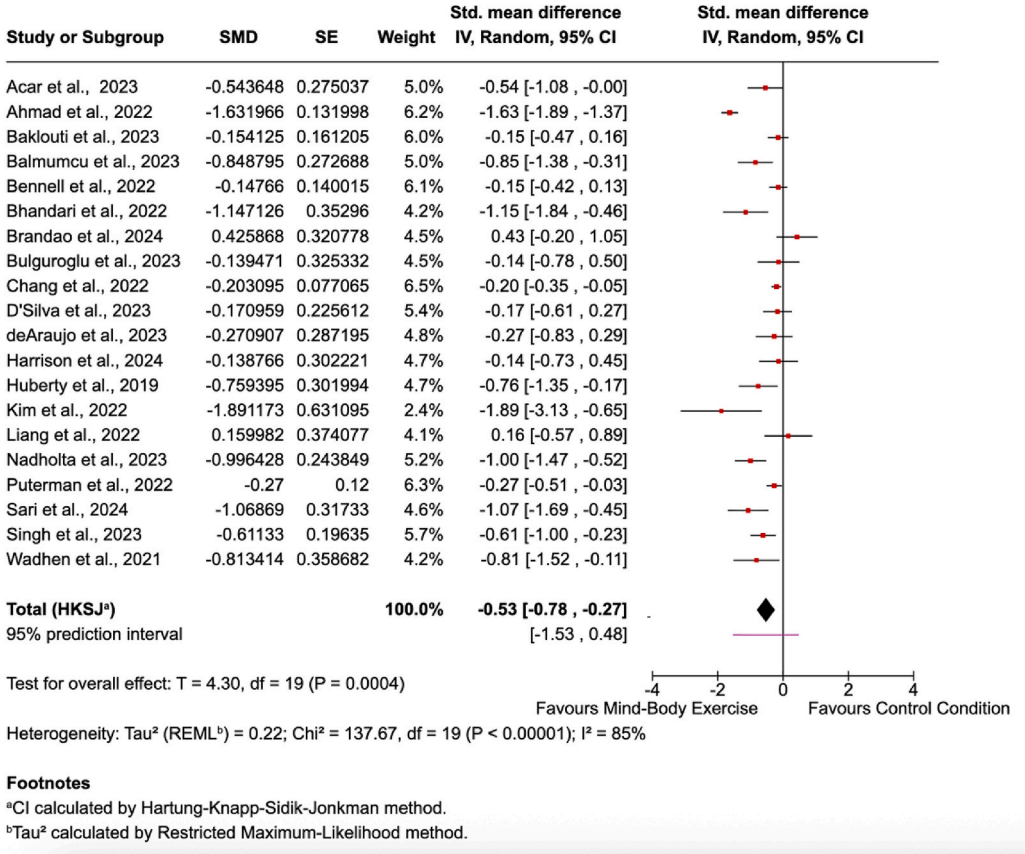

Fig. 3. Forest plot showing change in depression outcomes in the intervention and control conditions.

4.5. Overall effects of digital MBE interventions on symptoms of anxiety

Fifteen studies contributed to the anxiety meta-analysis. Pooled effects from these studies showed that digital MBE interventions significantly decreased symptoms of anxiety compared to control conditions (N = 1684, d = −0.55, 95% CI (−1.07, −0.04), p = 0.04, Fig. 4). Heterogeneity across studies was high (I^2 = 94%). Egger's regression test was not significant (β_1 = −1.75, SE = 3.03; z = −0.58; p = 0.56). A trim-and-fill analysis using a random-effects model revealed that the pooled effect size attenuated and lost significance after accounting for publication bias (d = −0.55, 95% CI -1.02, 0.08).

4.6. Overall effects of digital MBE interventions on symptoms of stress

Ten studies contributed to the stress meta-analysis. Two of the included studies (Nadholta et al., 2023; Wadhen & Cartwright, 2021) measured stress using two different instruments: the Perceived Stress Scale (PSS) and the Depression, Anxiety and Stress Scales (DASS). For consistency, the former was selected as the primary outcome measure for those studies because of its use in several other studies included in the analysis.

Fig. 5 presents the pooled effect sizes, showing that digital MBE interventions significantly reduced stress symptoms, compared to control conditions (n = 1388, d = - 0.69, 95% CI (−1.11, −0.27), p < 0.05). Heterogeneity was high across the studies (I^2 = 86%). Egger's regression test indicated a slight asymmetry (β_1 = −2.62, SE = 1.30; z = −2.01; p = 0.04). However, the trim-and-fill adjusted effect size remained very similar to the original (adjusted d = −0.69, CI -1.04, −0.34), suggesting that publication bias had minimal impact on the overall results.

4.7. Overall effects of digital MBE interventions on quality of life

Ten studies contributed to the quality of life meta-analysis. Fig. 6 shows the pooled effect sizes from these studies, demonstrating that digital MBE interventions led to a significant improvement in quality of life compared to control conditions (n = 694, d = 0.49, 95% CI (0.08, 0.91), p = 0.03). Heterogeneity was moderate-to-high (I^2 = 75%). Egger's regression test was not significant (β_1 = 2.85, SE = 1.568; z = 1.82; p = 0.07). The random-effects trim-and-fill analysis indicated that the results remained largely unchanged after adjusting for potential publication bias (adjusted d = 0.49, 95% CI 0.16 to 0.8).

4.8. Subgroup analyses

Table 2 reports exploratory subgroup analyses and formal tests of subgroup differences. Although some statistically significant subgroup differences were identified, analyses were not designed to establish definitive differences between delivery formats and the limited number of studies within subgroups means that these findings should be interpreted with caution.

Analyses suggested that intervention effects may vary by control condition and delivery mode. Reductions in depression, stress and anxiety were statistically significant when digital MBE interventions were compared with waitlist or inactive controls, but not when compared with active controls. The control condition did not appear to influence quality of life.

Delivery mode also appeared relevant. Synchronous interventions delivered through live videoconferencing were associated with significant improvements in depression, anxiety, stress and quality of life. Asynchronous interventions delivered through pre-recorded videos were associated with significant reductions in stress only.

Age did not significantly moderate effects on anxiety (p = 0.62), depression (p = 0.71) or stress (p = 0.92). However, age explained a significant proportion of between-study variance in quality of life, $F(2,8)$ = 8.09, p = 0.012, R^2 = 61.76%, with smaller improvements observed in older samples. Gender was not examined as a moderator because women comprised 79% of the overall sample, limiting meaningful comparison. Because most included interventions were yoga-based, the pre-planned subgroup analysis by MBE type was not performed.

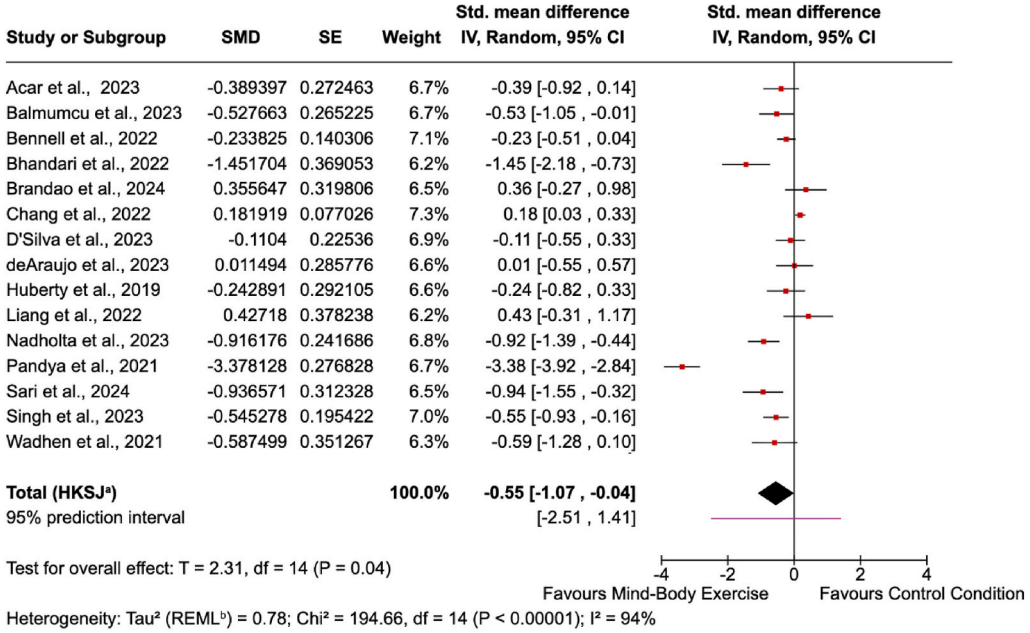

Fig. 4. Forest plot showing changes in anxiety outcomes in the intervention and control conditions.

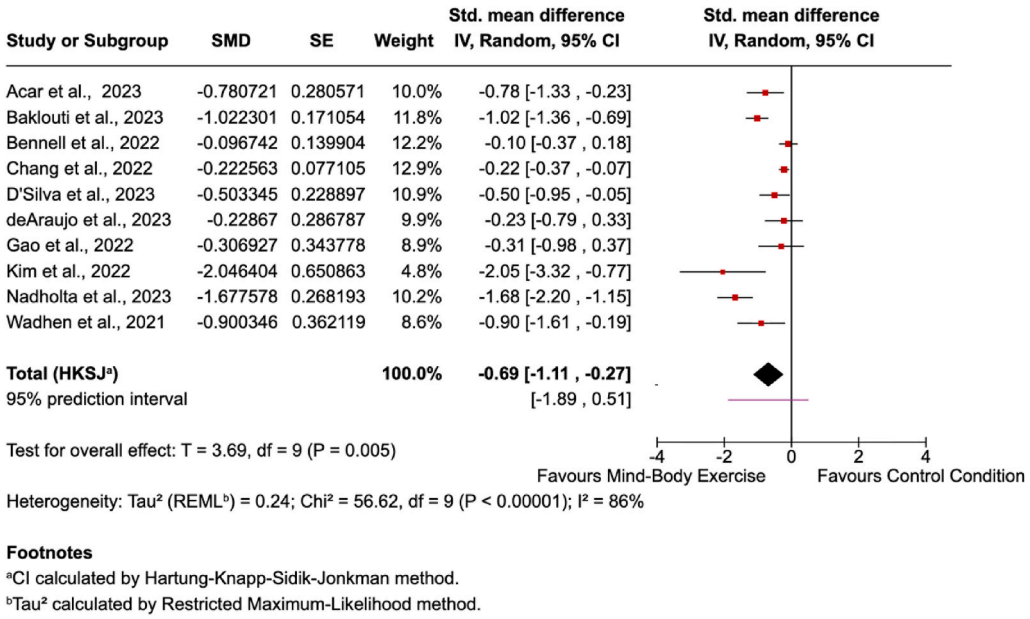

Fig. 5. Forest plot showing change in stress outcomes in the intervention and control conditions.

4.9. Sensitivity analyses

Findings for depression remained significant following exclusion of studies with a high ROB (SMD = −0.50; 95% CI -0.82, −0.17; P = 0.003).The effect for stress was attenuated and only marginally significant (SMD = −0.29; 95% CI -0.57, 0.00, P = 0.05). Anxiety (SMD = −0.27; 95% CI -0.66, 0.12, P = 0.15) and quality of life effects were no longer statistically significant (SMD = 0.24; 95% CI -0.03, 0.51, P = 0.08). Taken together, these analyses suggest that the evidence for depression and stress is more robust than the evidence for anxiety and quality of life.

5. Discussion

This review synthesised 23 RCTs involving 2586 participants and found that digitally delivered MBE interventions may be associated with short-term improvements in depression, anxiety, stress and quality of life in adults compared with control conditions. However, heterogeneity was substantial to considerable, and the certainty of evidence was low for depression, stress and quality of life, and very low for anxiety. Findings on quality of life and anxiety require particular caution because the pooled effect was no longer statistically significant after exclusion of studies with a high ROB. Effects for depression and stress appeared comparatively more robust, remaining significant after the exclusion of studies with a high ROB.

These findings extend previous evidence supporting the mental health benefits of in-person yoga, tai chi, Pilates and qigong interventions (Cramer et al., 2013; Fleming & Herring, 2018; Gu et al., 2021; Wang et al., 2014), while complementing broader reviews of digitally delivered exercise interventions that largely focused on aerobic and resistance-based modalities (Brinsley et al., 2025; Chen et al., 2024). Exploratory subgroup analyses suggested larger pooled effects in studies

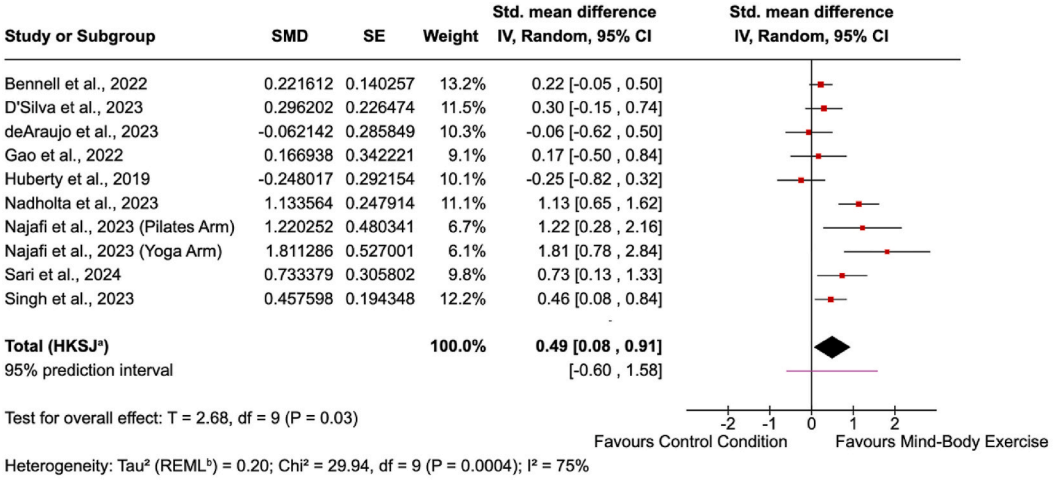

Fig. 6. Forest plot showing change in quality-of-life outcomes in the intervention and control conditions.

Table 2
Subgroup analyses outcomes.

	Number of studies	Intervention, n	Control, n	Meta-analysis		Heterogeneity		I^2 (%)	Subgroup test, P value
				Standardised mean difference (95% CI)	*P* value	T^2	X^2		
Depression									
Control Condition									
Waitlist	12	777	833	−0.74 (−1.09, −0.39)	0.0008	0.23	109.92	85	0.02
Active	7	249	260	−0.21 (−0.56, 0.22	0.22	0.06	11.58	48	-
Digital Modality									
Asynchronous delivery	5	497	509	−0.37 (−0.93, 0.19)	0.14	0.12	11.59	78	< 0.001
- Synchronous delivery	−13	−376	−430	- −0.49 (−0.79, −0.19)	−0.004	−0.13	−32.79	−64	-
Anxiety									
Control Condition									
Waitlist control	11	654	683	−0.76 (−1.44, −0.08)	0.03	0.94	189.78	95	0.04
Active control	4	187	199	−0.11 (−0.45, 0.23)	0.39	0.00	3.08	4	-
Digital Modality									
Asynchronous delivery	5	497	516	−0.15 (−0.74, 0.45)	0.53	0.15	18.96	82	0.13
- Synchronous delivery	−10	−344	−366	- −0.75 (−1.50, 0.00)	−0.05	−1.02	−124.91	−93	-
Stress									
Control Condition									
Waitlist control	6	478	542	−1.00 (−1.64, −0.35)	0.01	0.29	49.40	87	0.004
- Active control	−4	−190	−178	- −0.23 (−0.53, 0.07)	−0.09	−0.01	−2.37	−11	-
Digital Modality									
Asynchronous delivery	3	215	255	−0.20 (−0.37, −0.03)	0.04	0.20	20.68	73	0.0008
- Synchronous delivery	−7	−453	−465	- −0.94 (−1.08, −0.43)	−0.005	−0.00	−0.73	−0	-
Quality of Life									
Control Condition									
Waitlist control	5	148	133	0.80 (−0.16, 1.76)	0.08	0.46	20.48	84	0.13
- Active control	−5	−214	−200	−0.25 (−0.02, 0.52)	−0.06	−0.00	−3.83	−0	-
Digital Modality									
Asynchronous delivery	4	178	156	0.21 (−0.37, 0.80)	0.32	0.05	5.41	44	0.12
- Synchronous delivery	−6	−184	−176	−0.71 (0.03, 1.40)	−0.04	−0.29	−19.23	−79	-

using synchronous delivery than in studies using asynchronous delivery for depression and stress outcomes. Taken together, the findings suggest that remote delivery might preserve at least some of the therapeutic processes through which MBE supports psychological wellbeing, but the evidence remains too limited to draw firm conclusions about format-specific superiority.

The comparatively more robust findings for depression and stress might reflect the therapeutic profile of many MBE interventions. Unlike exercise approaches primarily centred on exertion or fitness, MBE interventions typically integrate movement with breath regulation, attentional focus, relaxation and embodied awareness(Gard et al., 2014; Schmalzl et al., 2015). These features might influence emotional regulation and stress responsivity through intertwined psychological and physiological pathways, including reductions in rumination and autonomic arousal, and improved parasympathetic regulation and interoceptive awareness (Pascoe et al., 2017; Streeter et al., 2012). By contrast, findings relating to anxiety and quality of life were less consistent. This inconsistency may partly reflect differences in participant populations, intervention intensity, baseline symptom severity and outcome measures.

Digital delivery should not be understood simply as a mode of intervention transmission. It also shapes how MBE interventions are experienced. Remote delivery can also reduce practical barriers associated with travel, scheduling, mobility limitations, and stigma, all of which can limit engagement in physical activity and mental health interventions (Firth et al., 2019; Vancampfort et al., 2015). For some individuals, participating from home might increase comfort, autonomy and psychological safety (Kasaven et al., 2023). At the same time, digital delivery can weaken or alter important aspects of intervention experience, including instructor responsiveness, social connection, group cohesion and embodied co-presence (James-Palmer et al., 2022). Interventions incorporating synchronous delivery methods may therefore provide additional interpersonal and motivational advantages through real-time supervision, feedback, accountability, and opportunities for shared participation, although evidence remains preliminary (Costa et al., 2023; Şen et al., 2025). Such factors are increasingly recognised as central to engagement and sustained participation within health interventions more broadly (Kelly et al., 2020). Differences in these contextual conditions may therefore partly explain the variation in effectiveness across studies, particularly where interventions ranged from live instructor-led sessions to fully asynchronous video-based programmes.

The substantial heterogeneity observed across studies is unlikely to reflect methodological differences alone. Variation in intervention content, delivery, facilitation and the degree of interpersonal support may also represent differences in how digital MBE is experienced and implemented, potentially influencing engagement and effectiveness (Ryan & Deci, 2000; Stubbs et al., 2018). Understanding these contextual influences will be important for interpreting variation in future studies.

Exploratory subgroup analyses suggested larger effects in studies using inactive or waitlist comparators than active controls. This pattern is common in behavioural intervention research and may partly reflect non-specific effects such as expectancy, attention or engagement.

However, the relatively small number of studies using active comparators limits firm conclusions.

Clinically, digitally delivered MBE may represent a useful adjunct where access to in-person provision is limited (Kasaven et al., 2023). However, successful implementation is likely to depend on digital accessibility and adequate technical and interpersonal support, particularly for populations already at risk of digital exclusion (Fuentes Diaz et al., 2024; Gravesande et al., 2023; Rodriguez et al., 2020). Recognising these disparities is crucial, alongside identifying strategies to reach groups who may be disproportionately excluded from digital delivery, but who may benefit from it the most. Future implementation efforts may therefore benefit from flexible or hybrid delivery models, approaches co-produced with service users and strategies aimed at reducing digital inequalities. Beyond healthcare settings, these findings may also be relevant to related contexts such as sport, exercise and community wellbeing programmes, where digitally delivered MBEs may support engagement, self-regulation, recovery and psychological wellbeing.

5.1. Strengths and limitations

This review provides a comprehensive evaluation into the effects of digital MBE interventions on depression, anxiety, stress, and quality of life, in adults. Rigorous methodological approaches were followed, and an adequate number of studies were included in the meta-analyses. All studies were published in peer-reviewed academic journals and employed RCT designs to ensure the credibility of the evidence.

Whilst these findings are broadly consistent with previous research on in-person MBE (Dong et al., 2024; Fleming & Herring, 2018; Li et al., 2020; Wen et al., 2025; Zhu et al., 2021; Zou et al., 2018), firm conclusions remain difficult, and interpreting pooled effects requires caution. Substantial heterogeneity was observed across intervention formats, participant populations, comparator conditions and outcome measures (Ciaccioni et al., 2024; Vancampfort et al., 2021). Although subgroup analyses were undertaken, these were exploratory and based on aggregate study-level data, and the limited number of studies per outcome together with inconsistent reporting of potential effect modifiers constrained further investigation of heterogeneity; a larger evidence base will be needed before moderator analyses can be interpreted with confidence.

Sensitivity analyses excluding high risk of bias studies showed that the effect sizes for depression and stress remained similar and significant, suggesting that heterogeneity may stem from other factors. For stress, the effect size decreased but remained significant, indicating potential influences from additional study features. The analyses revealed that the effects on quality of life were no longer significant. This was also the case for the effects on anxiety, while additional analyses revealed that these effects may also be overestimated due to impact of publication bias. These findings reduce confidence in the robustness of the observed effect and limit the conclusions that can be drawn regarding the potential impact of digital MBE interventions on quality of life and anxiety outcomes.

Furthermore, MBE includes a wide range of modalities (e.g., tai chi, qigong), but the majority of included studies focused on yoga. This limited the scope of the comparisons and may have affected the conclusions drawn. Gender was also not explored as a variable in the post-hoc analyses, as the majority of participants (79%) were female, consistent with other research indicating a higher prevalence of MBE engagement among women (Vergeer et al., 2023). As a result, the generalisability of findings to male participants is limited. This gender skew may also reflect underlying differences in engagement preferences or help-seeking behaviours, raising questions about whether current digitally delivered MBE interventions are acceptable or effective across genders.

5.2. Future directions

Future research should prioritise three areas. First, adequately powered randomised controlled trials with credible active comparator groups are needed to determine whether digitally delivered MBE interventions provide benefits beyond non-specific effects associated with participating in an intervention, such as receiving attention from researchers or instructors, expecting to improve, or engaging in a structured activity.

Second, future studies should strengthen the evidence base by evaluating digital MBE interventions across a broader range of populations, particularly men, older adults, people with diagnosed mental health conditions and other underrepresented populations. Research should move beyond establishing whether digital MBE interventions are effective, towards understanding how they can be implemented successfully in routine practice. This includes identifying the digital features, intervention characteristics and delivery approaches that promote sustained engagement, determining whether a minimum effective dose exists, and establishing which components are most important for different populations and settings.

6. Conclusion

This review suggests that digital MBE interventions may offer a useful option for supporting short-term improvements in depression and stress in adults, particularly in contexts where digital delivery may improve access or feasibility. However, confidence in these findings remains limited by substantial heterogeneity and generally low certainty of evidence, while findings for anxiety and quality of life remain particularly uncertain. More definitive conclusions will require adequately powered randomised controlled trials of digital MBE interventions with transparent intervention reporting, credible active comparator groups and longer-term follow-up periods.

CRediT authorship contribution statement

Hannah Fabian: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Marina Verdaguer-Rodríguez:** Writing – original draft, Writing – review & editing. **Chloe French:** Methodology, Writing – review & editing. **Katarzyna Karolina Machaczek:** Methodology, Writing – review & editing. **Jacinta Brinsley:** Methodology, Writing – review & editing. **Luana Scrivano:** Methodology, Writing – review & editing. **Joseph Firth:** Conceptualization, Supervision, Writing – review & editing. **Chelsea Sawyer:** Methodology, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Given their role as an Editorial Board member, Joseph Firth J., had no involvement in the peer-review of this article and had no access to information regarding its peer-review.

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List of abbreviations

CLARIFY CheckList stAndardising the Reporting of Interventions For Yoga
COVID-19 Coronavirus disease 2019
GRADE Grading of recommendations, assessment, development and evaluation
HMP-REaDER Holistic Movement Practice REsearch DEsign and Reporting Guidelines
MBE Mind-body exercise
PRISMA Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO International prospective register of systematic reviews
RCT Randomised Control Trial
ROB Risk of Bias
SE Standard error
SMD Standardised mean difference

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.mhpa.2026.100807.

Data availability

This study is a systematic review and meta-analysis. No new participant-level data were generated. All extracted data were derived from previously published studies.

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