

Effectiveness of Mindfulness-based Therapy for Reducing Anxiety and Depression in Patients With Cancer

A Meta-analysis

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Abstract: Anxiety and depression are common among patients with cancer, and are often treated with psychological interventions including mindfulness-based therapy.

The aim of the study was to perform a meta-analysis of the effectiveness of mindfulness-based interventions for improving anxiety and depression in patients with cancer.

Medline, the Cochrane Library, EMBASE, and Google Scholar were searched. The randomized controlled trials designed for patients diagnosed with cancer were included. Mindfulness-based interventions were provided.

The outcomes assessed were the changes in anxiety and depression scores from before to after the intervention. The treatment response was determined by calculating the standardized mean difference (SMD) for individual studies and for pooled study results. Subgroup analyses by cancer type, type of therapy, and length of follow-up were performed.

Seven studies, involving 469 participants who received mindfulness-based interventions and 419 participants in a control group, were included in the meta-analysis. Mindfulness-based stress reduction and art therapy were the most common interventions (5/7 studies). All studies reported anxiety and depression scores. The pooled SMD of the change in anxiety significantly favored mindfulness-based therapy over control treatment (-0.75 , 95% confidence interval -1.28 , -0.22 , $P=0.005$). Likewise, the pooled SMD of the change in depression also significantly favored mindfulness-based therapy over control (-0.90 , 95% confidence interval -1.53 , -0.26 , $P=0.006$). During the length of follow-ups less than 12 weeks, mindfulness-based therapy significantly improved anxiety

for follow-up ≤ 12 weeks after the start of therapy, but not >12 weeks after the start of therapy.

There was a lack of consistency between the studies in the type of mindfulness-based/control intervention implemented. Patients had different forms of cancer. Subgroup analyses included a relatively small number of studies and did not account for factors such as the severity of anxiety and/or depression, the time since diagnosis, and cancer stage.

Mindfulness-based interventions effectively relieved anxiety and depression among patients with cancer. However, additional research is still warranted to determine how long the beneficial effects of mindfulness-based therapy persist.

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Abbreviations: CI = confidence interval, SMD = standardized mean difference.

INTRODUCTION

A diagnosis of cancer can have a significant impact, not only on individuals' physical well being, but also on their psychological well being. Such a diagnosis, and the ensuing developments/events, can challenge psychological well being in a multitude of manners, particularly through stress, anxiety, and depression related to symptoms, treatment (including potential side effects) and recovery (or potential death), and financial and family concerns.^{1,2} As such, it is hardly surprising that anxiety and depression are very common among patients with cancer.^{3,4}

Although chemotherapy and radiotherapy can be effective for treating the underlying physical cause(s) of cancer, these treatments do not always affect or improve the psychological well being. Indeed, anxiety, tension, and depression are often experienced before and after, as well as during, treatment.² Therefore, psychosocial interventions have been developed in an attempt to help manage the psychological manifestations of cancer. These psychological interventions can take a multitude of forms, but ultimately aim to behaviorally reduce stress, tension, and anxiety.² There is also evidence that improved psychological well being can affect treatment outcomes² and reduce cancer-related pain.⁵ Despite the fact that many studies, systematic reviews, and meta-analyses over the years have examined the impact of psychological interventions in patients with various types of cancer, there is a lack of definitive evidence as to whether such interventions are effective.⁶⁻⁸ Further, relatively few published meta-analyses have examined the effect of psychological interventions on anxiety and depression in patients with cancer.

A multitude of psychological interventions have been used in the context of cancer care, including cognitive/behavioral, education, counseling, hypnosis, relaxation, and mindfulness-based interventions.¹ In recent meta-analyses, Faller et al⁹ reported on changes in anxiety and depression after face-to-face

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psychological interventions, whereas Galway et al,¹⁰ in a Cochrane review, reported on changes in anxiety and depression after psychological interventions comprising interpersonal dialog between a trained helper and patients newly diagnosed with cancer. Mindfulness-based therapy revolves around the Buddhist concept of mindfulness, defined as intentional nonjudgmental awareness of present-moment experiences,¹¹ and comprises various forms, including mindfulness-based cognitive therapy, mindfulness-based stress reduction, and mindfulness-based art therapy. Mindfulness-based cognitive therapy targets cognitive processes underlying depression, through a series of group sessions, psychoeducation, and meditation.¹² Mindfulness-based stress reduction comprises the presentation of theories related to the body–mind connection, meditation, and relaxation, group and individual meditation, and group activities designed to support the practical application of mindfulness.¹³ Mindfulness-based art therapy involves the integration of group art therapy and mindfulness meditation.^{14,15}

To our knowledge, only a few recent meta-analyses have examined the effectiveness of mindfulness-based therapy for improving anxiety and depression in patients with cancer; however, 2 of these analyses^{16,17} were restricted to patients with breast cancer only, whereas the other¹⁸ included both patients with cancer and survivors of cancer. To our knowledge, no recent meta-analysis has strictly examined the effect of mindfulness-based therapy on changes in anxiety and depression in patients with cancer. Further, since the publication of the aforementioned meta-analyses, the findings from an important randomized study of mindfulness-based therapy in women with breast cancer has been published.¹⁵ Given this information, and that anxiety and depression are common among patients with cancer and that mindfulness-based therapy is a popular approach for managing these afflictions,¹¹ we decided to carry out a meta-analysis in an attempt to obtain definitive, up-to-date information on this relevant aspect of cancer management.

The aim of this meta-analysis of randomized controlled trials (RCTs) published in the peer-reviewed literature was to assess the overall effectiveness of mindfulness-based therapy for relieving anxiety and depression among patients with any form of cancer.

MATERIALS AND METHODS

Eligibility Criteria

Inclusion Criteria

Studies were considered for inclusion in the meta-analysis if they were RCTs that involved adult participants diagnosed with cancer (including stage 0 cancer), who received mindfulness-based interventions with the comparison of usual care and reported outcomes for the change from baseline in anxiety and depression after the intervention.

Exclusion Criteria

Studies were excluded if they did not evaluate changes in anxiety or depression. Articles published in the form of letters, comments, editorials, and case reports were excluded, as were those published in non-English language journals.

Search Strategy

Medline, the Cochrane Library, EMBASE, and Google Scholar were searched (search date: November 30, 2014) using the following key words: cancer/neoplasm/carcinoma;

depression; anxiety; mindfulness/meditation/psychotherapy/behavior therapy. The approval by an institutional review board is not required for this study because humans were not studied.

Study Selection and Data Extraction

Studies were independently identified by 2 reviewers (and data extracted) using the aforementioned search strategy. A third reviewer was consulted to resolve any differences in opinion between these reviewers regarding study eligibility and data extraction.

The following information was extracted from studies that met the eligibility criteria: the name of the first author, year of publication, study design, participant demographics and diagnoses, questionnaires or tools used for evaluation, and outcome measures.

Outcome Measures

The outcomes of interest were the change in measures of anxiety and depression from before to after the intervention.

Quality Assessment

The quality of the studies included in the meta-analysis was assessed by the 2 reviewers using the Cochrane Risk of Bias Tool.¹⁹ Again, disagreement between reviewers was resolved by consulting a third reviewer.

Statistical Analysis

The changes from baseline to after the intervention in anxiety and depression were compared between participants who received mindfulness-based therapy and those who received control interventions. Subgroup analysis was also performed, whereby the changes in anxiety and depression were compared on the basis of diagnosis, type of intervention, and the length of follow-up. A change in standardized mean difference (SMD) from before and after intervention, with a corresponding 95% confidence interval (CI), was applied for each outcome measure. An SMD <0 indicated the intervention group might have higher improvement to decrease the anxiety or depression than the control group; an SMD >0 indicated the intervention group might have lower improvement to decrease the anxiety or depression than the control group; an SMD = 0 indicated both intervention and control group have similar change. Cochran Q statistic and I^2 were used to carry out a chi-square–based test of homogeneity. I^2 represents the level of the total variability in effect estimates among trials caused by heterogeneity rather than chance. If heterogeneity was detected ($I^2 > 50%$), random-effects models of analysis were used. Otherwise, the data were analyzed using fixed-effects models. A 2-sided P value <0.05 was taken to indicate statistical significance for one comparison group over the other. The leave-one-out approach was used to perform the sensitivity analysis for the outcomes of clinical trial. Funnel plots for the outcomes and Egger test were used to assess the publication bias. The data points forming a symmetrical funnel-shaped distribution indicated the absence of publication bias. For Egger test, a 1-tailed significance level >0.05 indicated the absence of publication bias. The software used for all analyses was Comprehensive Meta-Analysis statistical software, version 2.0 (Biostat, Englewood, NJ).

RESULTS

Literature Search

After the removal of duplicates, a total of 293 articles were identified in the literature search (Fig. 1). Of these, the majority

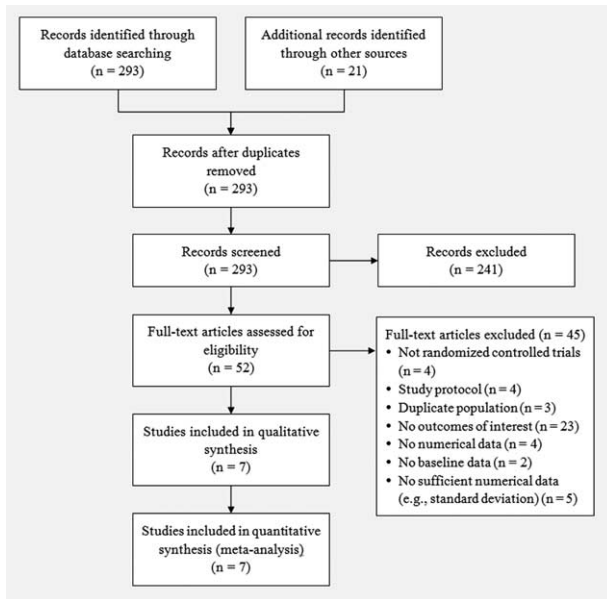


FIGURE 1. Flowchart of study selection. RCT=randomized controlled trial.

was excluded and 52 underwent full-text review. Of the articles that underwent full-text review, 45 were excluded (most commonly because they did not report the outcomes of interest) and 7 RCTs^{12-15,20-22} were included in the meta-analysis.

Study Characteristics

The key characteristics of the studies included in the meta-analysis are summarized in Table 1. Studies involving participants with breast cancer were most common. The type of intervention varied between studies; however, mindfulness-based stress reduction (3 studies) and mindfulness-based art therapy (2 studies) were the most common interventions. Control group participants were typically wait-listed for mindfulness-based therapy (5 studies). The number of participants in each study ranged from 32 to 114 (total = 469) for the mindfulness-based therapy groups, and from 39 to 115 (total = 419) for the control groups. The age of the participants (generally around 50 years) was similar between studies and between groups within studies. As most of the studies involved women with breast cancer, there was a predominance of female participants. In the studies of participants with other types of cancer (apart from prostate and gynecologic cancer), the proportion of participants who were men ranged from 1.4% to 23.6% in the intervention groups, and from 21.7% to 27.0% in the control groups. The majority of patients included patients who had stage I to III cancer, although there was some variability between studies. Where reported, there were no between-group differences within each study with regards to ethnicity, level of education, marital status, or work status. The length of the intervention was 8 weeks in 6 studies and 7 weeks in 1 study.

Outcome Measures

Tables 2 and 3, respectively, summarize anxiety and depression scores before and after the intervention, and the type of instrument used for assessment. The Symptom Checklist

90-Revised and the Profile of Mood States short form scale were the most commonly used instruments for the assessment of anxiety and depression, respectively. Only Hoffman et al²¹ and Bränström et al²² reported outcomes at different time points.

Meta-analysis of Anxiety

All 7 studies were included in the meta-analysis of the change in anxiety (Figure 2A). As there was evidence of significant heterogeneity among the studies, a random-effects model of analysis was used (Q statistic = 76.30, $I^2 = 92.14%$, $P < 0.001$). The pooled SMD indicated anxiety was improved to a significantly greater extent in the mindfulness-based therapy group compared with the control group (pooled SMD = -0.75, 95% CI -1.28 to -0.22, $P = 0.005$).

For the subgroup analysis, the pooled SMD revealed that there were significant differences between the mindfulness-based therapy and control groups with respect to the type of intervention (Table 4, supplementary Figure 2A, <http://links.lww.com/MD/A506>) and length of follow-up (≤ 12 weeks and > 12 weeks; Table 4, Supplementary Figure 3A, <http://links.lww.com/MD/A506>). Specifically, mindfulness-based art therapy (pooled SMD = -0.40, 95% CI -0.66 to -0.14, $P = 0.003$) and mindfulness-based cognitive therapy (pooled SMD = -0.53, 95% CI -0.92 to -0.15, $P = 0.007$) were associated with significant improvement in anxiety. Regarding the duration of follow-up, mindfulness-based therapy was associated with significantly improved anxiety for follow-up ≤ 12 weeks after the start of the intervention (pooled SMD = -0.43, 95% CI -0.58 to -0.28, $P < 0.001$), but not for follow-up > 12 weeks after the start of the intervention (pooled SMD = -1.119, 95% CI -2.63 to 0.393, $P = 0.147$). There were no significant effects of treatment when the data were stratified by cancer type (breast and mixed; Table 4, Supplementary Figure 1A, <http://links.lww.com/MD/A506>).

Meta-analysis of Depression

A total of 7 studies were included in the meta-analysis of the change in depression scores (Figure 2B). As there was evidence of significant heterogeneity among the studies, a random-effects model of analysis was used (Q statistic = 105.95, $I^2 = 94.34%$, $P < 0.001$). The pooled SMD indicated that depression was improved to a significantly greater extent in the mindfulness-based therapy group compared with the control group (pooled SMD = -0.90, 95% CI -1.53 to -0.26, $P = 0.006$).

For the subgroup analysis, mindfulness-based stress reduction was not associated with a significant change in depression for patients with breast cancer (Table 4, Supplementary Figure 1B, <http://links.lww.com/MD/A506>), but was associated with a significant improvement in depression for patients with the other cancer types (pooled SMD = -0.60, 95% CI -0.81 to -0.38, $P < 0.001$). Mindfulness-based art therapy (pooled SMD = -0.69, 95% CI -0.954 to -0.426, $P < 0.001$) and mindfulness-based cognitive therapy (pooled SMD = -0.80, 95% CI -1.19 to -0.40, $P < 0.001$) were associated with significantly decreased depression. Regarding the duration of follow-up, mindfulness-based therapy was associated with significantly decreased depression for follow-up ≤ 12 weeks after the start of the intervention (pooled SMD = -0.52, 95% CI -0.75 to -0.29, $P < 0.001$), but not for follow-up > 12 weeks after the start of the intervention.

TABLE 1. Summary of Key Characteristics of Studies Included in the Meta-analysis

Ist Author (year)	Type of Cancer	Intervention	N	Age (y)*	Male, n (%)	Cancer Stage, 0/I/II/III/IV/Unknown (%)	Ethnicity	Education	Marital Status	Work Status	Length of Intervention
Monti (2013)	Breast	MBAT	98	56.9 (range 31–87)	0	1/37/26/11/3/22	NS	NS	NS	NS	8 wks
		General education	44	57.4 (range 31–78)	0	0/45/30/5/0/20					
Henderson (2013)	Breast	MBSR	53	50 (8) [†]	0	0/55/45/0/0/0	NS	NS	NS	NS	8 wks
		Usual care	58		0	0/52/48/0/0/0					
Hoffman (2012)	Breast	MBSR	114	49.6 (9.3)	0	10/30/41/20/0/0	NR	NS	NR	NS	8 wks
		Wait list	115	50 (9.1)	0	5/39/41/15/0/0					
Bränström (2010)	Mixed	MBSR	32	51.8 (9.9) [†]	1 (1.4)	NR	NR	NS	NR	NS	8 wks
		Wait list	39								
Foley (2010)	Mixed	MBCT	55	54.8 (9.1)	13 (23.6)	0/11/36/30/24/0	NR	NR	NR	NS	8 wks
		Wait list	60	55.5 (11.9)	13 (21.7)	0/17/28/30/25/0					
Monti (2006)	Mixed	MBAT	56	53.1 (12.4)	0	52/48 [§]	NS	NR	NR	NR	8 wks
		Wait list	55	54.1 (10.7)	0	51/49 [§]					
Specca (2000)	Mixed	MBSR	61	54.9 (10.5)	7 (13.2)	0/19/51/15/15/0	NR	NR	NS	NR	7 wks
		Wait list	48	48.9 (13.2)	10 (27.0)	0/22/16/30/30/3					

MBAT = mindfulness-based art therapy; MBCT = mindfulness-based cognitive therapy; MBSR = mindfulness-based stress reduction; NR = not reported; NS = no statistical difference.

* Data presented as mean (standard deviation), except when indicated. † Intervention and control group combined.

§ For early stage (0–II)/late stage (III–IV).

|| For patients who completed the program only.

TABLE 2. Summary of Anxiety Outcomes Before and After Mindfulness-based Therapy

Ist Author (y)	Instrument	Groups	Time Point	Number	Before	After	Change
Monti (2013)	SCL-90-R	I	9 wks	74	—	—	−0.10 (−0.20, 0)*
		C		40	—	—	
Henderson (2013)	SCL-90-R	I	16 wks	53	—	—	0.14 (0.05)
		C		58	—	—	0.28 (0.05)
Hoffman (2012)	POMS	I	8–12 wks	103	13.16 (7.20)	10.32 (7.00)	—
		C		111	13.42 (7.24)	13.36 (7.20)	—
		I	12–14 wks	103	13.16 (7.20)	10.33 (7.02)	—
		C		111	13.42 (7.24)	12.73 (6.59)	—
Bränström (2010)	HADS	I	12 wks	25	10.53 (4.70)	8.26 (4.46)	—
		C		35	10.44 (4.59)	9.29 (3.97)	—
		I	24 wks	21	10.53 (4.70)	8.32 (4.40)	—
		C		37	10.44 (4.59)	9.54 (5.10)	—
Foley (2010)	HAM-A	I	10 wks	53	15.58 (8.79)	5.58 (5.13)	—
		C		54	14.37 (9.93)	8.90 (8.39)	—
Monti (2006)	SCL-90-R	I	8 wks	56	—	—	−0.16 (−0.29, −0.02)*
		C		55	—	—	
Specia (2000)	POMS	I	7 wks	53	9.7 (6.6)	5.4 (5.8)	—
		C		37	8.1 (6.3)	7.9 (6.7)	—

C = control group, HADS = Hospital Anxiety and Depression Scale (anxiety subscore), HAM-A = Hamilton Anxiety Rating Scale, I = intervention group, POMS = Profile of Mood States Short-form Scale (anxiety subscore), SCL-90-R = Symptom Checklist 90-Revised (anxiety subscore), STAI = State-Trait Anxiety Inventory.

*Mean difference (95% confidence interval of the mean change between the intervention and control groups).

Sensitivity Analysis

Figure 3 shows forest plots of the SMD for anxiety (Figure 3A) and depression (Figure 3B), with individual studies removed, in turn, for the mindfulness-based versus control treatments. The direction and magnitude of the combined estimates did not change markedly with the exclusion of

individual studies, indicating that the meta-analyses had good reliability.

Quality Assessment

Figure 4 summarizes the results of the quality assessment. The vast majority of the studies were considered to have

TABLE 3. Summary of Depression Outcomes Before and After Mindfulness-based Therapy

Ist Author (y)	Instrument	Groups	Time Points	Number	Before	After	Change
Monti (2013)	SCL-90-R	I	9 wks	74	—	—	0.21 (0.11, 0.30) *
		C		40	—	—	
Henderson (2013)	SCL-90-R	I	16 wks	53	—	—	0.31 (0.08)
		C		58	—	—	0.58 (0.08)
Hoffman (2012)	POMS	I	8–12 wks	103	12.79 (10.76)	10.00 (9.95)	—
		C		111	15.70 (12.79)	14.96 (13.23)	—
		I	12–14 wks	103	12.79 (10.76)	10.34 (10.32)	—
		C		111	15.70 (12.79)	14.10 (11.60)	—
Bränström (2010)	HADS	I	12 wks	25	6.41 (4.46)	4.67 (4.23)	—
		C		35	7.18 (3.55)	6.49 (3.30)	—
		I	24 wks	21	6.41 (4.46)	4.85 (4.20)	—
		C		37	7.18 (3.55)	6.57 (4.04)	—
Foley (2010)	HAM-D	I	10 wks	53	16.02 (7.28)	6.26 (5.43)	—
		C		54	14.38 (8.12)	10.27 (6.93)	—
Monti (2006)	SCL-90-R	I	8 wks	56	—	—	−0.19 (−0.30, −0.07)*
		C		55	—	—	
Specia (2000)	POMS	I	7 wks	53	14.1 (10.5)	8.4 (8.9)	—
		C		37	13.3 (9.4)	13.0 (9.9)	—

C = control group, CESD = Center for Epidemiological Studies Depression Scale, HADS = Hospital Anxiety and Depression Scale (depression subscore), HAM-D = Hamilton Rating Scale for Depression, I = intervention group, POMS = Profile of Mood States Short-form Scale (depression subscore), SCL-90-R = Symptom Checklist 90-Revised (depression subscore).

*Mean difference (95% confidence interval of the mean change between the intervention and control groups).

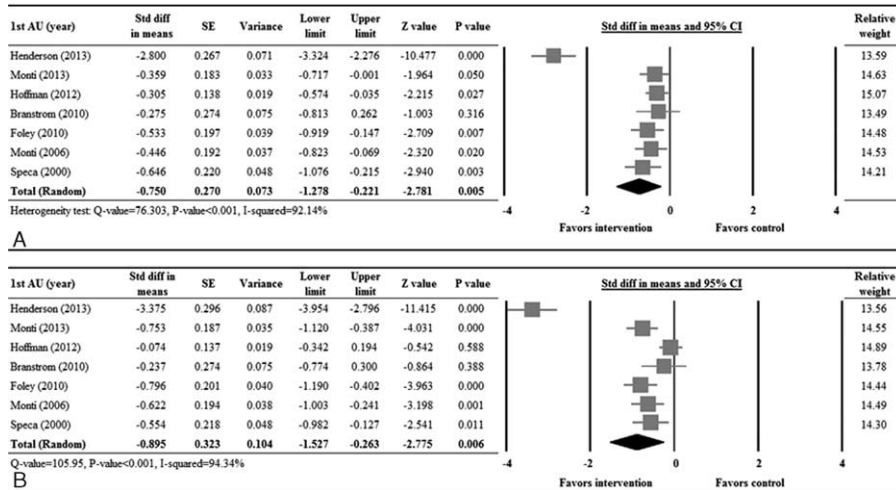


FIGURE 2. Forest plot of intervention versus control for the change in anxiety (A) and depression (B). CI = confidence interval, lower limit = lower bound of the 95% CI, SE = standard error of mean, SMD = standardized mean difference, upper limit = upper bound of the 95% CI.

inadequate blinding of participants. Other study characteristics were generally considered to be associated with a low risk of bias.

publication bias among the studies reporting anxiety ($P = 0.093$) or depression ($P = 0.043$).

Publication Bias

Figure 5 shows the Funnel plots for the studies reporting anxiety and depression scores. There was no evidence of

DISCUSSION

In this meta-analysis, we examined the effects of mindfulness-based interventions on anxiety and depression in

TABLE 4. Subgroup Analysis

	N	Anxiety			Depression		
		SMD (95% CI)	P Value	Heterogeneity	SMD (95% CI)	P Value	Heterogeneity
Diagnosis							
Breast cancer only	3	-1.136 (-2.427, 0.156)	0.085	Q-value = 73.45, P value <0.001, I ² = 97.28%	-1.380 (-2.963, 0.203)	0.088	Q-value = 102.83, P value <0.001, I ² = 98.06%
Mixed cancer	4	-0.247 (-0.774, 0.280)	0.359	Q-value = 1.21, P value = 0.750, I ² = 0%	-0.596 (-0.808, -0.384)	<0.001	Q-value = 2.76, P value = 0.430, I ² = 0%
Intervention							
MBAT	2	-0.4 (-0.66, -0.141)	0.003	Q-value = 0.108, P value = 0.742, I ² = 0%	-0.69 (-0.954, -0.426)	0.000	Q-value = 0.239, P value = 0.625, I ² = 0%
MBSR	4	-0.997 (-2.033, 0.039)	0.059	Q-value = 72.42, P value <0.001, I ² = 95.86%	-1.045 (-2.313, 0.222)	0.106	Q-value = 104.60, P value <0.001, I ² = 97.13%
MBCT	1	-0.533 (-0.919, -0.147)	0.007	NA	-0.796 (-1.19, -0.402)	0.000	NA
Length of follow-up							
≤12 wks	6	-0.434 (-0.584, -0.284)	<0.001	Q-value = 1.94, P value = 0.857, I ² = 0%	-0.522 (-0.751, -0.293)	<0.001	Q-value = 10.86, P value = 0.054, I ² = 53.97%
>12 wks	3	-1.119 (-2.631, 0.393)	0.147	Q-value = 72.28, P value <0.001, I ² = 97.23%	-1.218 (-3.104, 0.669)	0.206	Q-value = 104.59, P value <0.001, I ² = 98.09%

CI = confidence interval, MBAT = mindfulness-based art therapy, MBCT = mindfulness-based cognitive therapy, MBSR = mindfulness-based stress reduction, n = number of studies, NA = not assessed, SMD = standardized mean difference.

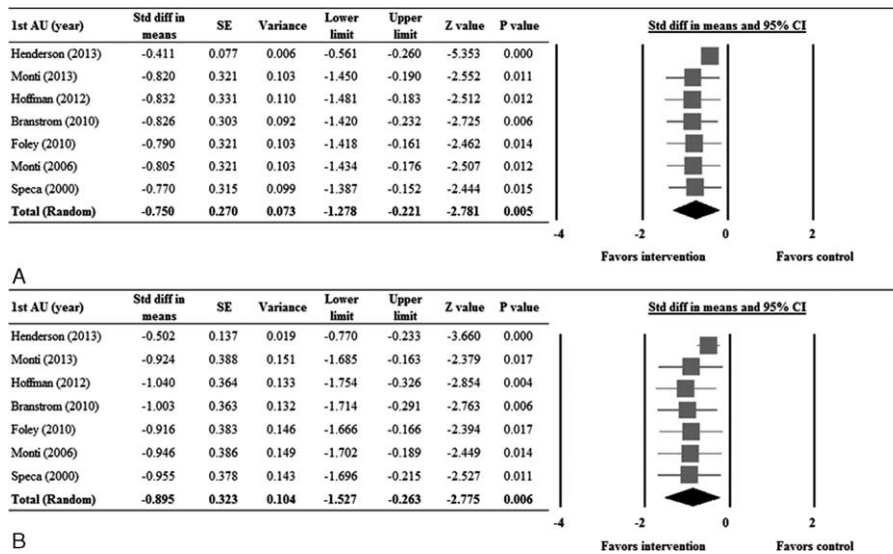


FIGURE 3. Forest plots of sensitivity analysis examining the influence of each study on the pooled estimate for anxiety (A) and depression (B). The leave-one-out approach was used. CI = confidence interval, lower limit = lower bound of the 95% CI, SE = standard error of mean, SMD = standardized mean difference, upper limit = upper bound of the 95% CI.

patients with cancer. A total of 7 RCTs (involving 888 participants) met the criteria for inclusion in the meta-analyses. Participants in most studies had breast cancer, whereas the type of mindfulness-based intervention varied between studies. However, our meta-analyses were found to be reliable, with no evidence of publication bias or study design biases (apart from the unavoidable lack of double-blinding).

Our overall findings indicated that mindfulness-based therapy is effective for reducing anxiety and depression, whereas our subgroup analysis findings indicated that this may depend on the type of therapy administered and that the effect of treatment may not last longer than 12 weeks.

The overall results of our meta-analyses revealed that mindfulness-based therapy significantly improved measures of anxiety and depression. Our findings are similar to those reported in several other recent meta-analyses on this topic. Specifically, in a meta-analysis of 9 studies, Zainal et al¹⁷ found that mindfulness-based stress reduction significantly reduced anxiety and depression in women with breast cancer. Only 2 of the 9 studies in the meta-analysis, however, were RCTs. Cramer et al¹⁶ similarly reported that mindfulness-based stress reduction reduced anxiety and depression in women with breast cancer in a meta-analysis of 3 RCTs; however, only postintervention changes, rather than the change from before to after the intervention, were considered. In another meta-analysis of 9 RCTs, Piet et al¹⁸ likewise found that mindfulness-based stress reduction or cognitive therapy significantly reduced both anxiety and depression among patients with cancer or survivors of cancer.

The duration of mindfulness-based therapy was 8 weeks in the majority of studies, whereas the timing of postintervention assessment(s) varied considerably. This variation in the timing of the assessment of benefit allowed us to perform subanalysis to assess the persistence of benefit with time. To this end, our subanalysis revealed that the effect of mindfulness-based therapy was significant at ≤12 weeks after the start of intervention, but not at >12 weeks after the start of the intervention. It should be noted, however, that only 2 studies incorporated

longer term assessment of benefit. Therefore, we suggest that further studies, with a longer duration of follow-up, are needed to determine how long any beneficial effects of mindfulness-based therapy persist.

In addition to the overall findings, subgroup analysis revealed several significant effects of mindfulness-based therapy, most notably that both anxiety and depression were improved to a greater extent with mindfulness-based art therapy compared with control, whereas the reverse was true for mindfulness-based stress reduction. These findings suggest that the type of mindfulness-based therapy implemented is important and that some therapies may be effective, whereas others may not be effective. Our findings regarding anxiety and depression, and mindfulness-based cognitive therapy are consistent with of a number of other meta-analyses, notably those reported by Faller et al⁹ and Osborn et al,²³ who found that cognitive behavioral therapy was effective for relieving anxiety and depression in participants who had survived cancer. In contrast to our findings, Galway et al¹⁰ found no such effects of different psychosocial interventions on anxiety or depression. This lack of an impact may reflect the fact that few studies were included in the analyses and that participants in the studies included in the meta-analysis were newly diagnosed and had not yet had time to develop marked anxiety or depression regarding their cancer. It is unclear why mindfulness-based stress reduction was found to have a negative impact on anxiety and depression in our meta-analysis.

Our meta-analysis has a number of limitations that warrant mention. Firstly, there was a lack of consistency between the studies in terms of the specific type of mindfulness-based intervention implemented and indeed the type of control intervention. This lack of consistency may have affected the overall results of our meta-analysis, and as such, our results must be interpreted with some degree of caution. Indeed, as suggested by the results of our subgroup analyses, it is possible that some mindfulness-based interventions may be effective for relieving anxiety and/or depression among patients with cancer, whereas others may not be effective. Secondly, although we presume

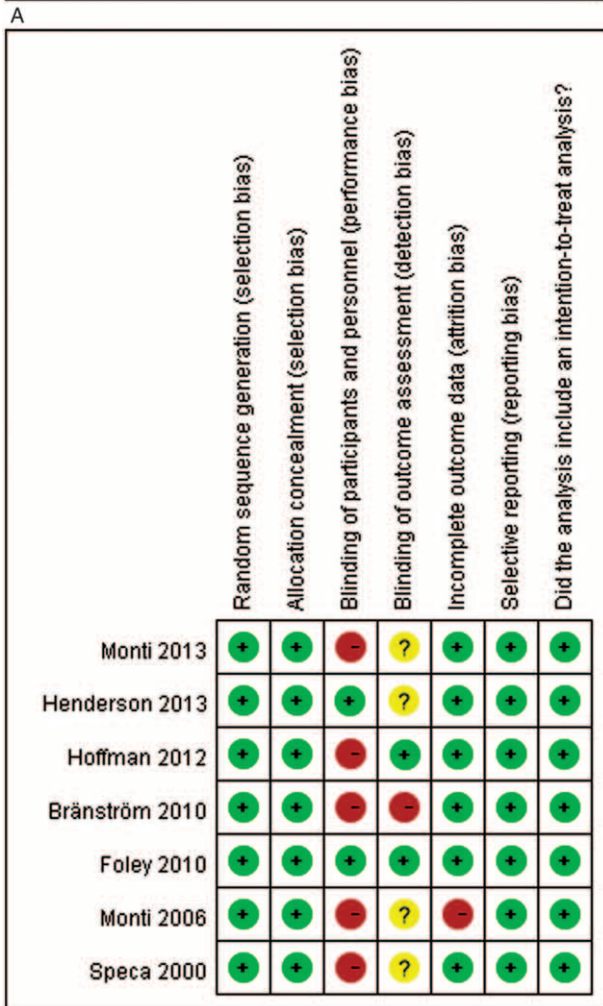
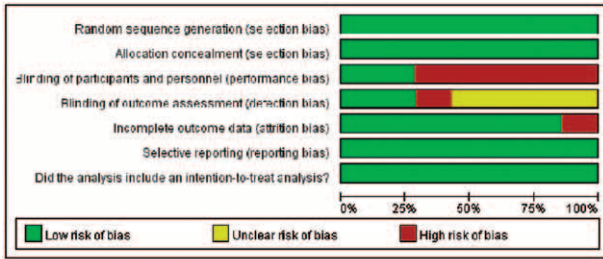


FIGURE 4. Quality assessment of studies: A, risk of bias graph; B, risk of bias summary.

that the patients in the studies included in our meta-analysis were not receiving potentially confounding medical or somatic treatment for anxiety or depression during the course of the study, we cannot rule out this possibility as no specific statements to this effect were provided in the reporting articles. Thirdly, we included studies involving patients with different forms of cancer, rather than a single form of cancer. Fourthly, the subgroup analyses only included a relatively small number of studies and thus cannot be considered definitive. Finally, although we carried out subgroup analyses to assess the effects of cancer type, form of therapy, and follow-up duration, we

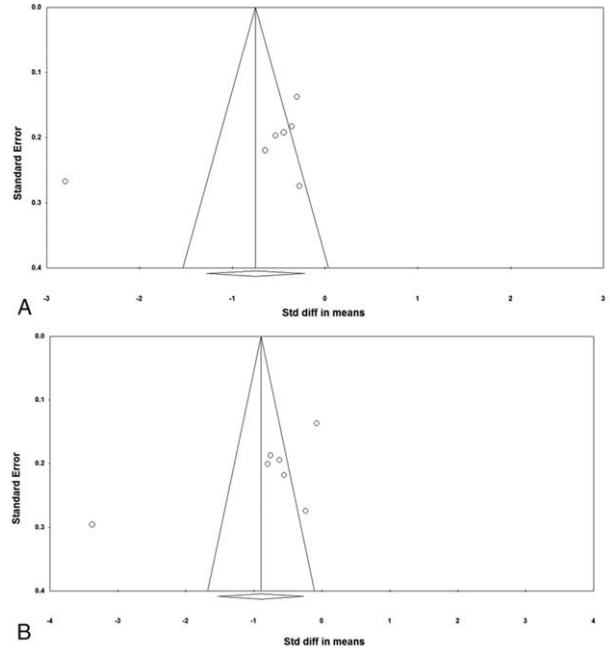


FIGURE 5. Funnel plots for publication bias: A, anxiety; B, depression.

were not able to consider other factors that could impact the severity of anxiety and/or depression, such as time since diagnosis and stage of cancer. Clearly, additional well designed studies would be useful to definitively determine whether certain mindfulness-based therapies may provide some benefit to patients with cancer who are suffering anxiety and/or depression, and the impact of patient factors on treatment responsiveness. Despite these limitations, our study is strengthened by the fact that we restricted our analyses to results from high-quality studies (ie, RCTs). This is in contrast with other similar meta-analyses^{17,24} on this topic, which have also included non-RCTs. However, it would limit the number of eligible RCTs and total sample size (number of participants).

In conclusion, the results of our meta-analysis of RCTs suggest that mindfulness-based interventions can relieve anxiety and depression among patients with cancer. However, our subgroup analyses, although clearly limited by the small number of eligible studies, suggest that the effect of mindfulness-based therapy may not persist over the long term and that some forms of mindfulness-based interventions may be less effective for relieving anxiety and depression. Clearly, further research is warranted to more definitively determine which forms of mindfulness-based therapy may be effective in this context and how best to optimize the persistence of benefits obtained.

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