

ABSTRACT

We conducted a meta-analysis to provide a comprehensive review of mindfulness-based treatments (MBT). We included 166 publications (168 studies) enrolling 9,082 participants receiving MBT for a variety of psychological disorders and physical or medical conditions. Effect size estimates suggested that MBT were moderately effective when compared to waitlist control group (Hedge's $g = .53$), and in pre-post studies (Hedge's $g = .60$). When compared with other treatments, MBT showed smaller effect sizes (Hedge's $g = .33$), these effect sizes were even smaller when comparing MBT with other psychological treatments (Hedge's $g = .20$). The results obtained were robust and were maintained at follow-up. In all groups, clinical effect sizes were positively related to the mindfulness effect sizes. However, clinical effect sizes were positively related to the duration of the mindfulness training/practice in both pre-post and treatment controlled studies but not in waitlist controlled studies. Study quality score showed to be related to higher clinical effect sizes in pre-post studies, to lower effect sizes in treatment controlled studies, and unrelated to clinical effect sizes in waitlist controlled studies. Clinical significance analyses suggest a significant effect on both anxiety and depression.

Introduction

Meta-analysis (description)	Number of studies	Hedge's g Cohen's d	95% CI	Z	p	Heterogeneity (I^2) (%)	Fail-safe N
Baer (2003) (general)	18	0.59 (d)	-	-	-	-	-
Grossman et al. (2004) (only MBSR)	20	0.53 (d)	[0.23, 0.81]	-	< 0.004	-	-
Ledesma et Kumano (2009) (MBSR with cancer, only randomized studies)	10	0.48 (d)	[0.38, 0.59]	-	< 0.0001	-	-
Hoffman et al. (2010) (Anxiety and depression, pre-post)	39	0.63 (g)	[0.53, 0.73]	21.82	< 0.01	-	4,302

Results from previous empirical reviews on mindfulness-based treatments (MBT) suggest that they can be beneficial in reducing stress, anxiety, and depression, and that they are useful in treating distress associated with physical or psychosomatic illness (Baer, 2003; Bohlmeijer, Prenger, Taal, & Cuijpers, 2010; Grossman, Niemann, Schmidt, & Walach, 2004; Hofmann, Sawyer, Witt, & Oh, 2010; Ledesma & Kumano, 2009). Although most studies found a moderate effect size, some effect sizes were small, whereas others were large. The differences in these results might be partially due to the inclusion/exclusion criteria. The results from three reviews suggested that MBT show larger effect sizes when targeting psychological disorders (e.g., anxiety and depression) and smaller effects when targeting physical conditions (e.g., chronic pain) (Baer, 2003; Grossman et al., 2004; Ledesma & Kumano, 2009). Effect sizes were also maintained at follow-up, suggesting that mindfulness practice can have a long-term effect (Baer, 2003; Hofmann et al., 2010).

Objectives

- 1) Update the results since the review of Baer (2003)
- 2) Compare our results with those from previous meta-analyses
- 3) Compare MBT with other treatments including psychological ones
- 4) Outline the conditions that make MBT more or less effective

Method

Selection of Studies

Search engines: PubMed and PSYCINFO
Language of publication: English
Date of publication: until April 3rd, 2011
Search terms: "mindfulness or MBSR or MBCT"

Studies were excluded if:

- (1) they did not include a mindfulness-based intervention
- (2) they did not aim at examining treatment effects
- (3) they consisted of comparisons among meditators or among meditation styles
- (4) they studied non-direct effect of mindfulness
- (5) they were augmented by cognitive or behavior strategies
- (6) no clinical outcomes were available
- (7) data were not sufficient to compute the effect size (e.g., only correlational data)
- (8) data overlapped with other included studies

PubMed searches produced 504, and PSYCINFO provided 1174 publications. We carefully assessed the obtained publications and applied the exclusion criteria, resulting in 105 publications from PubMed and 61 publications from PSYCINFO for a total of 166 publications (140 journal articles and 26 dissertations) and a total of 168 studies, given that in two publications, we included two distinct studies.

Procedure

Numerical data pertaining to each study were extracted including: the year of publication, number of participants, mean age, % of males, attrition, follow-up time, length of treatment, length of home practice, and study quality score. We also included descriptors such as: study design, treatment protocol, target population, diagnostic, therapy setting, treatment delivery, and gender.

To investigate the impact of categorical variables, we used the effect size and the 95% CI. For numerical variables, we used meta-regression. We completed all analyses using Microsoft Excel or Comprehensive Meta-Analysis. To minimize the influence of data selection, we included data pertaining to all available outcomes. We identified two groups of outcomes: clinical and mindfulness. We included data post-treatment and at the last follow-up, when available. Each study was assessed using a quality score, inter-rater reliability was .91.

Effect sizes were computed using means/ SD when available, otherwise, the effect sizes were computed using other statistics such as F , p , t , and χ^2 . To assess publication bias, we computed the fail-safe N and constructed a funnel plot. We also assessed the clinical significance of MBT on both anxiety and depression.

Mindfulness as a clinical intervention: a meta-analysis

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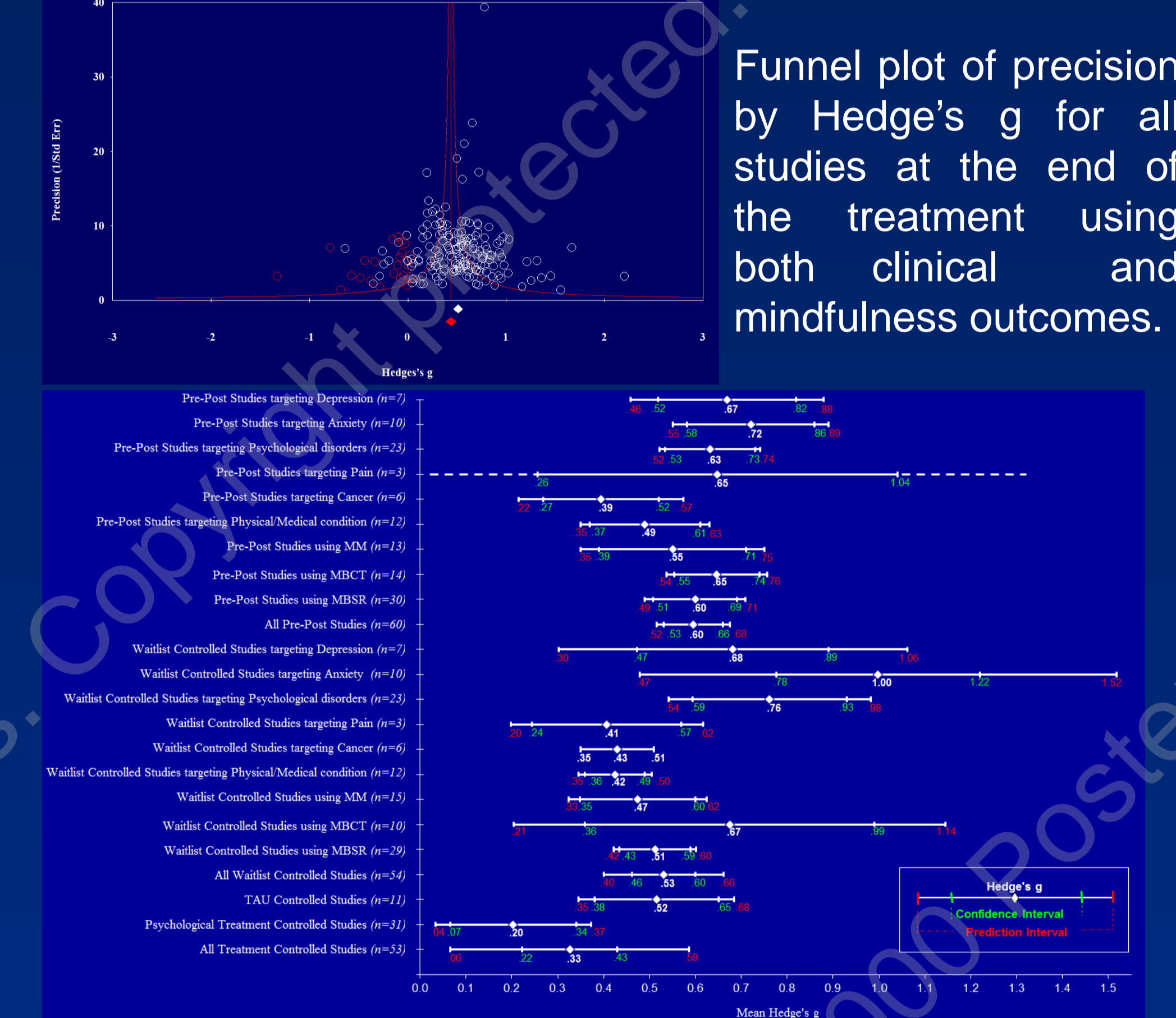
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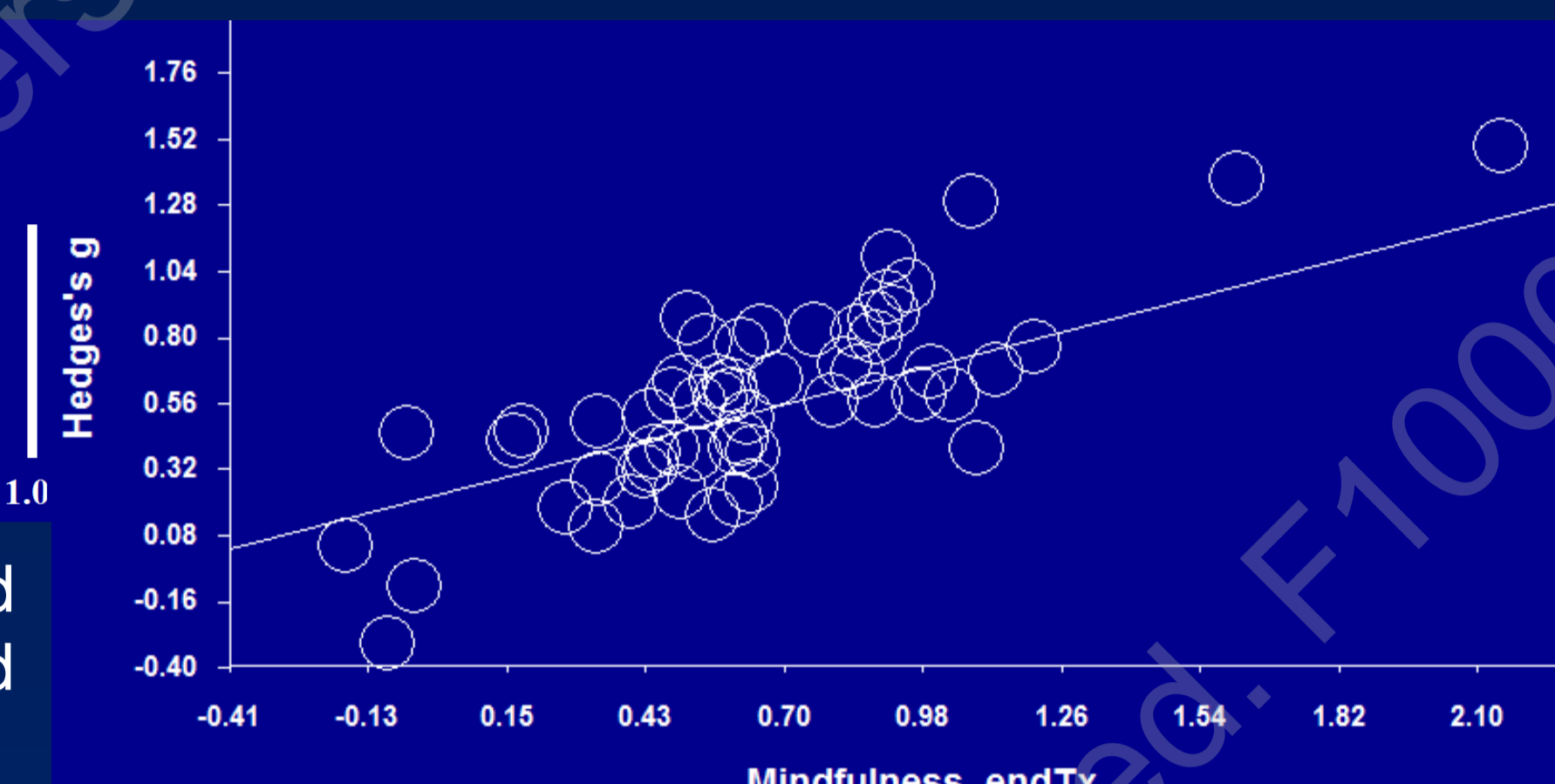
Results

Group by Subgroup within study	Statistics for each study					Hedge's g and 95% CI	
	Hedge's g	Lower limit	Upper limit	Z-Value	p-Value		
Pre-Post Studies	0.60	0.53	0.66	17.50	0.00		
Treatment Controlled Studies	0.33	0.22	0.43	6.30	0.00		
Waitlist Controlled Studies	0.53	0.46	0.60	14.14	0.00		

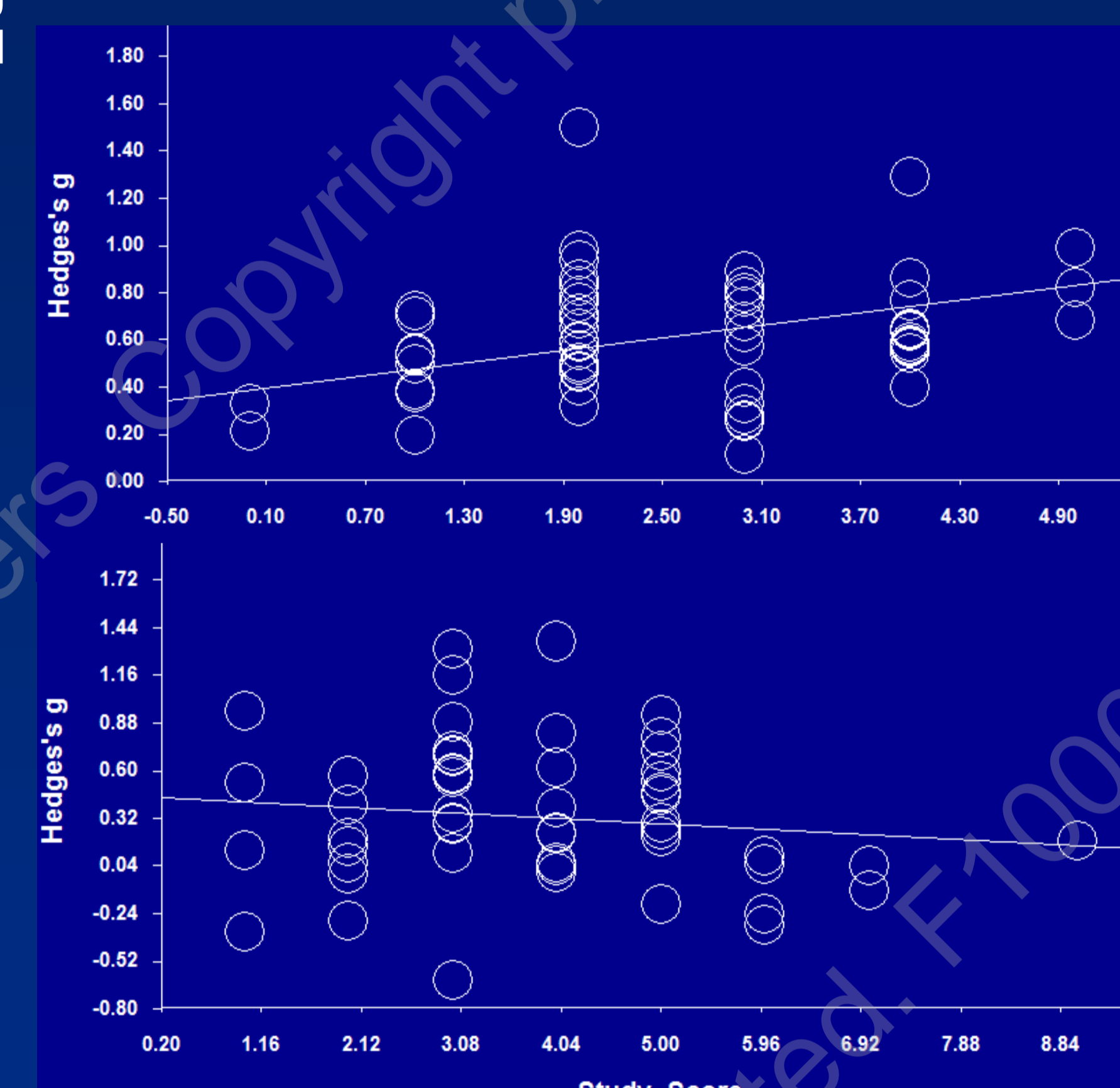
This graph illustrates the results of the studies grouped according to the study design (pre-post, waitlist controlled and treatment controlled studies)



Mean Hedge's g , 95% confidence interval, and 95% prediction interval for main studies' groups. Note that the effect sizes were calculated at the end of the treatment and solely based on the clinical outcomes



This graph shows that the average effect size of clinical outcomes is positively moderated by the mindfulness outcomes at the end of treatment ($n = 58$), ($\beta = .47$, $SE = .05$, $p < .001$)



Measure	Number of studies	Level at pre-treatment	Level at post-treatment	Level at follow-up
Anxiety (BAI)	10	mild	asymptomatic	asymptomatic
	9	moderate	mild	mild
	1	severe	moderate	moderate
Anxiety (STAI)	8	Non-anxious	Non-anxious	Non-anxious
	16	Moderately-anxious	Non-anxious	Non-anxious
	5	Highly-anxious	Moderately-anxious	Moderately-anxious
Depression (BDI-I)	25	mild	asymptomatic	asymptomatic
	5	moderate	mild	-
	5	severe	mild	-
Depression (BDI-II)	10	mild	asymptomatic	asymptomatic
	5	moderate	asymptomatic	asymptomatic
	3	severe	mild	mild
Depression (CES-D)	3	Non-depressed	Non-depressed	Non-depressed
	6	Moderately-depressed	Non-depressed	Non-depressed

This table represents the clinical significance of the MBT for both anxiety (measured by BAI and STAI) and depression (measured by BDI-I, BDI-II, and CES-D)

These two graphs show that the average effect size of clinical outcomes is positively moderated by the study quality score for pre-post studies ($n = 60$), ($\beta = .09$, $SE = .012$, $p < .001$), and negatively moderated by the study quality scores for treatment controlled studies ($n = 53$), ($\beta = -.03$, $SE = .012$, $p < .01$). Note that the average effect size of clinical outcomes was found to be unrelated to the study quality score for waitlist controlled studies score ($n = 54$, $p = .65$)

Conclusion

First, the results indicate that MBT is moderately effective in pre-post studies (Hedge's $g = .60$), and more effective when compared to a course/seminar (Hedge's $g = .58$), to TAU (Hedge's $g = .52$), and to waitlist control group (Hedge's $g = .53$). These results were maintained at follow-up. MBT demonstrated a greater effect for psychological disorders (Hedge's $g = .63$) than for physical or medical conditions (Hedge's $g = .49$). Specifically, MBT showed large effects in treating anxiety and depression.

Second, when compared with other treatments, MBT showed also to be generally more effective, but with smaller effect sizes (Hedge's $g = .33$), these effect sizes were even smaller when comparing MBT with other psychological treatments (Hedge's $g = .20$).

Third, MBT had a moderate to large effect size on mindfulness outcomes at post-treatment for pre-post studies (Hedge's $g = .76$), a moderate effect size for waitlist controlled studies (Hedge's $g = .63$), and a moderate to small effect size for treatment controlled studies (Hedge's $g = .36$). Similar results were obtained at follow-up.

Fourth, in all groups, clinical effect sizes were positively related to the mindfulness outcomes. However, the duration of mindfulness treatment/home practice were both slightly positively correlated with the average effect size of the clinical outcomes in pre-post and treatment controlled studies but surprisingly not in waitlist controlled studies.

Fifth, study quality score showed to be related to higher clinical effect sizes in pre-post studies, to lower effect sizes in treatment controlled studies, and unrelated to clinical effect sizes in waitlist controlled studies. These results suggest that conducting a higher quality research helps increasing the effect of MBT at post treatment but when compared with waitlist or other treatments, a higher research quality might not advantage MBT and even can benefit the control treatment.

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