Mindfulness-based stress reduction and health benefits: a meta-analysis
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CRD summary
This review assessed the effects of mindfulness-based stress reduction (MBSR) programmes on mental and physical health. The authors concluded that the results suggest that MBSR may help diverse populations to deal with clinical and non-clinical problems. The review assessed immediate post-intervention outcomes from a small number of studies of unknown quality. Consequently, the conclusions should be viewed as suggestive rather than definitive.

Authors' objectives
To assess the effects of mindfulness-based stress reduction (MBSR) programmes on health-related measures.

Searching
MEDLINE, PsycINFO, Web of Science and the Cochrane Library were searched; the search terms were reported. The reference lists of retrieved studies and a set of relevant theoretical publications were also screened. First authors of all identified studies were contacted for unpublished material, ongoing research, and details of any researchers with unpublished or ongoing studies. Studies published before December 2002 and data from unpublished studies obtained before December 2001 were included if there was at least an abstract in English.

Study selection
Study designs of evaluations included in the review
The inclusion criteria for study design were not specified. Controlled studies had to have an inactive control or an active control that controlled for the non-specific effects of the intervention group.

Specific interventions included in the review
Studies of programmes emphasising MBSR and taught to groups were eligible for inclusion. Mindfulness had to be interpreted as cultivating a moment-to-moment awareness with a non-judgmental attitude, the teaching of formal meditation techniques, and stressing the importance of daily and systematic practice. The programmes had to last 6 to 12 weeks with sessions lasting approximately 2.5 hours per week. Studies of intensive meditation retreat and studies reporting insufficient information about the intervention were excluded. The control interventions included waiting list, relaxation, attention placebo, social support, exercise, stress-management training and educational materials.

Participants included in the review
The inclusion criteria for the participants were not specified. The participants in the included studies were: patients diagnosed with fibromyalgia, mixed cancers, depression, chronic pain, anxiety, obesity and binge eating disorders, and psychiatric problems; prisoners (2 reports); and non-clinical populations seeking help to cope with stress (3 reports).

Outcomes assessed in the review
The studies had to report quantitative physical or mental health measures and assess outcomes using standardised and validated scales. The studies also had to report post-intervention data and present sufficient data to enable the calculation of an effect size (ES). Relatively unclear or unconventional measures were excluded.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors did not state that they assessed the validity of all of the studies. However, they did state whether the controlled trials were randomised or quasi-randomised. The authors did not state how the papers were assessed for validity, or how many reviewers performed the validity assessment.
Data extraction
One reviewer extracted and coded the data, while a second reviewer checked the coding. The studies were coded for study design, group allocation, type of control, study population, patients' diagnosis and outcome measures. Decisions on the inclusion and coding of outcome measures were reached through consensus among three reviewers. Immediate post-intervention and pre- to post-intervention outcomes data were extracted, but longer term outcomes data were not. Cohen's d ESs were calculated for the difference between the intervention and the control (taking account for the baseline difference in ES between treatment groups) and for the difference from baseline to post-treatment (using a global estimation of correlation between pre-and post-interventions measures of r=0.7). All ESs were corrected for small sample bias. For each study, a single ES was calculated separately for mental and physical health.

Methods of synthesis
How were the studies combined?
Weighted mean ESs and 95% confidence intervals (CIs) were calculated, with weighting by the inverse of the standard deviation. Pooled ESs were calculated separately for all controlled studies and using before-and-after data from observational studies and the MBSR treatment arms of controlled studies. Pooled ESs were calculated separately for physical and mental health.

How were differences between studies investigated?
Statistical heterogeneity was assessed using the Q statistic. Sensitivity analyses were undertaken by analysing studies according to population (patient versus non-patient) and group allocation (randomised versus quasi-experimental). Mental health data from RCTs were analysed separately.

Results of the review
Twenty studies were included in the review. Of these, 10 were controlled studies (n=771): 7 randomised controlled trials (RCTs; n=434) and 3 quasi-RCTS (n=337). The review included 18 sets of pre- and post-intervention data in the meta-analysis of observational data (n=894); it was unclear how many of these were from uncontrolled studies and how many represented one arm of the controlled studies.

Controlled studies.
The studies showed a medium statistically significant effect of MBSR on mental health (10 studies; d=0.54, 95% CI: 0.39, 0.68, P<0.001). No statistically significant heterogeneity was detected (P=0.999). The results from RCTs only were similar.

The studies showed a medium statistically significant effect of MBSR on physical health (5 studies, n=203; d=0.53, 95% CI: 0.23, 0.91, P=0.0004). No statistically significant heterogeneity was detected (P=0.29).

Observational studies.
The ESs were similar to those obtained from the controlled studies. Cohen's d for physical health was 0.42 (95% CI: 0.34, 0.50, P<0.001); no statistically significant heterogeneity was detected (P=0.18). Cohen's d for mental health was 0.50 (95% CI: 0.43, 0.56, P<0.001), but statistically significant heterogeneity was detected (P<0.0001). The heterogeneity remained statistically significant when subgroups of patients and others were analysed separately (patients, P<0.001; others, P=0.003).

Authors' conclusions
The results from a relatively small number of identified studies suggested that MBSR may help diverse populations to deal with clinical and non-clinical problems.

CRD commentary
The review question was clear in terms of the intervention and outcomes. Inclusion criteria were not explicitly defined for the study design or participants. Several relevant sources were searched and attempts were made to locate unpublished data, thus minimising publication bias. The methods used to select the studies were not described, so it is not known whether any efforts were made to reduce errors and bias. However, methods were used to minimise bias in the extraction of data. Studies with poor quantitative evaluations and inadequate statistical analysis were excluded, but the validity of the included studies was not formally assessed.

There was minimal information on the included controlled studies and no information on the before-and-after studies. It appears that data from trials with diverse populations and diverse outcomes were pooled and, therefore, although statistical heterogeneity was not detected in most analyses, the pooling might not have been valid because of this clinical diversity. Only immediate post-interventions outcomes were evaluated, which probably limits the clinical validity of the effects. The authors noted that most of the studies had methodological flaws and poor-quality studies tended to overestimate the effects of the treatment. In view of these limitations, the authors' conclusions should be regarded as suggestive rather than definitive.

**Implications of the review for practice and research**

Practice: The authors did not state any implications for practice.

Research: The authors stated that research to examine the long-term effects of mindfulness training is required. This research should use well-defined patient populations, rigorous methodology, and assess objective markers of disease as well as self-reported psychosocial and functional indicators of distress.

**Bibliographic details**


**PubMedID**

15256293

**DOI**

10.1016/S0022-3999(03)00573-7

**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Adaptation, Psychological; Chronic Disease; Cognition; Health Status; Humans; Stress, Psychological /prevention & control /psychology

**AccessionNumber**

12004009883

**Date bibliographic record published**

31/01/2006

**Date abstract record published**

31/01/2006

**Record Status**

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