

# Mindfulness-Based Stress Reduction for Stress Management in Healthy People: A Review and Meta-Analysis

Alberto Chiesa, M.D., and Alessandro Serretti, M.D., Ph.D.

## Abstract

**Background:** Mindfulness-based stress reduction (MBSR) is a clinically standardized meditation that has shown consistent efficacy for many mental and physical disorders. Less attention has been given to the possible benefits that it may have in healthy subjects. The aim of the present review and meta-analysis is to better investigate current evidence about the efficacy of MBSR in healthy subjects, with a particular focus on its benefits for stress reduction.

**Materials and methods:** A literature search was conducted using MEDLINE (PubMed), the ISI Web of Knowledge, the Cochrane database, and the references of retrieved articles. The search included articles written in English published prior to September 2008, and identified ten, mainly low-quality, studies. Cohen's *d* effect size between meditators and controls on stress reduction and spirituality enhancement values were calculated.

**Results:** MBSR showed a nonspecific effect on stress reduction in comparison to an inactive control, both in reducing stress and in enhancing spirituality values, and a possible specific effect compared to an intervention designed to be structurally equivalent to the meditation program. A direct comparison study between MBSR and standard relaxation training found that both treatments were equally able to reduce stress. Furthermore, MBSR was able to reduce ruminative thinking and trait anxiety, as well as to increase empathy and self-compassion.

**Conclusions:** MBSR is able to reduce stress levels in healthy people. However, important limitations of the included studies as well as the paucity of evidence about possible specific effects of MBSR in comparison to other nonspecific treatments underline the necessity of further research.

## Introduction

MINDFULNESS-BASED STRESS REDUCTION (MBSR) is a standardized meditation program created in 1979 from the effort to integrate Buddhist mindfulness meditation with contemporary clinical and psychological practice.<sup>1,2</sup> Even though it was originally developed as a group-based program for patients with chronic pain,<sup>3–5</sup> in the past two decades it has been proposed as a treatment for many diseases, showing a good efficacy for many mental and physical disorders.<sup>6–8</sup>

The main feature of MBSR is the cultivation of mindfulness, a concept that has its roots in Buddhism and can be firstly found in the *Abhidhamma*<sup>9</sup> and later in the *Visuddhimagga*, a summary of the part that deals with meditation.<sup>10</sup> It consists of the development of a particular kind of attention, charac-

terized by a nonjudgmental awareness, openness, curiosity, and acceptance of internal and external present experiences, which allows practitioners to act more reflectively rather than impulsively.<sup>5,11,12</sup>

MBSR comprehends three different techniques: body scan, which involves a gradual sweeping of attention through the entire body from feet to head, focusing noncritically on any sensation or feeling in body regions and using periodic suggestions of breath awareness and relaxation; sitting meditation, which involves both mindful attention on the breath or on the rising and falling abdomen as well as on other perceptions, and a state of nonjudgmental awareness of cognitions and of the stream of thoughts and distractions that continuously flows through the mind; and Hatha yoga practice, which includes breathing exercises, simple stretches, and posture

designed to strengthen and relax the musculoskeletal system.<sup>1</sup> The program consists of interventions and homework at home for at least 45 minutes a day, 6 days a week for 8 weeks,<sup>1,2</sup> although it can be provided in shorter or longer courses as well.

Despite great interest in the application of MBSR in mentally and physically ill patients, less attention has focused on the benefits this practice might have in healthy people, in particular, as a tool for the reduction of stress. Continuous stress may lead to unproductive rumination that consumes energy and strengthens the experience of stress itself.<sup>13</sup> Furthermore, intensified stress can undermine resilience factors<sup>14–16</sup> such as hope<sup>17</sup> and capacity to forgive.<sup>18</sup> Although a certain level of stress may result in improved performance, there is consistent evidence that too much stress can adversely affect physical and mental health.<sup>19–21</sup> MBSR, which teaches to observe situations and thoughts nonjudgmentally without reacting to them impulsively, helps people to develop a more reflexive awareness of inner and outer experiences, and could represent an efficacious tool for the reduction of stress.<sup>11,22</sup>

The aim of the present work is to review current evidence about the possibility of MBSR to reduce stress in nonclinical populations, and to answer to the following questions: Is there evidence that the efficacy of MBSR on stress reduction is superior to an inactive treatment? Is there evidence that MBSR is comparable to other active treatments in reducing stress? Can MBSR improve psychological symptoms and parameters other than stress?

## Materials and Methods

### Literature research

A literature search was conducted using MEDLINE (PubMed), the ISI Web of Knowledge, the Cochrane database, and the references of retrieved articles. The search included articles published from 1979 (when MBSR was conceived) to September 2008. The search strategy considered only studies published in English. The main search terms were MBSR, mindfulness, meditation, stress reduction, and healthy, in various combinations as needed.

### Selection of trials

The original search identified more than 150 articles, of which 10 were considered useful for our purpose (Table 1). Included studies had to: investigate the efficacy of a MBSR intervention; be performed in healthy subjects; use validated scales for the measurement of stress; and provide quantitative data. Controlled studies were required to have a control group procedure that was either inactive (e.g., a waiting list) and/or active and oriented to control for nonspecific effects of the mindfulness group (e.g., demand characteristics and expectancy effects); furthermore, studies comparing MBSR with another active treatment had to provide separate analyses for the two treatments. No limits in the number of subjects, duration of trials, or study design were considered. Excluded were: qualitative reports; studies investigating clinical populations or including subjects affected by physical or mental disorders; studies performed in healthy subjects but not reporting data on stress values; speculative reports; studies with sample data not specified; and studies

with data on MBSR and another active treatment grouped together. To be entered in our analysis, studies had to provide both pre- and post-test outcome variables or Cohen's *d* between post- and pre-test within-group differences. Studies not satisfying this last criterion but satisfying other inclusion and exclusion criteria were not meta-analyzed and were reviewed only in a narrative way.

### Outcome measures

The primary outcome measures were: the comparison between the Cohen's *d* calculated on pre- and post-test stress values related to MBSR compared to the values related to the inactive treatment; the comparison between the Cohen's *d* calculated on pre- and post-treatment spirituality values related to MBSR compared to the values related to the inactive treatment (spirituality intended as an overall sense of connection with something greater or transcendent or as a particular attitude characterized by openness to, and awareness and acceptance of, present experience); and both previously reported measures performed on the comparison between MBSR and a further active treatment. In order to reduce potential confounding factors (such as self-selection bias), for the analysis of stress-reduction and spirituality-enhancement, we performed a sensitivity analysis in randomized controlled trials separately. Secondary outcome measures were: rumination; empathy; self-compassion; state anxiety; and further psychological changes related to the MBSR program.

### Data extraction and quality assessment

The data were extracted from the original reports. Variables not completely described in the text or described only in a narrative fashion were extracted and calculated from the tables reported in the articles. The quality of controlled studies was assessed using the Jadad scale,<sup>23</sup> and the quality of cross-sectional studies with controls was assessed using the Newcastle-Ottawa scale<sup>24</sup> (Tables 2, 3). For both measures, a score  $\geq 3$  is considered to be indicative of a high quality study.

### Data analysis

Two separate Cohen's *d* were calculated for each study (three for the study with an active control group). The first was performed on the difference between post- and pre-intervention measures in the MBSR group and the other on the same difference in the control group. Cohen's *d* was calculated using gain scores and pooled standard deviations according to the standard formula:

$$d = (M \text{ post} - M \text{ pre}) / \sqrt{(\sigma \text{ post}^2 + \sigma \text{ pre}^2)/2}$$

where *M* post and *M* pre represent the final and initial mean values in the considered scales, respectively, and  $\sigma$ post and  $\sigma$ pre represent the final and initial standard deviations. In line with current conventions, effect sizes for improvements (i.e., reductions in stress and enhancement in spirituality) were reported as positive in sign.<sup>25</sup> Cohen's *d* of MBSR interventions and of control groups were then compared using *t*-test weighted for the number of participants. We opted for this method because different control strategies themselves can have different effects.

TABLE 1. SUMMARY OF INCLUDED STUDIES

Study	Meditation/ comparison	N	Population	Duration (weeks)	Study design	Measure of stress	Pre-post within-group effect size	Measures of spirituality	Pre-post within group effect size
Astin, 1997 <sup>34</sup>	MBSR/waiting list	7/12	University undergraduates	8 weeks; 3-month follow-up	RCT	GSI	n.c.	INSPIRIT	n.c.
Shapiro, 1998 <sup>27</sup>	MBSR/waiting list	36/37	Medical and premed students	7	RCT	GSI	0.632/0	INSPIRIT	n.c.
Rosenzweig, 2003 <sup>28</sup>	MBSR/waiting list	140/162	Medical and premed students	10	SS-CT	POMS	0.205/-0.339	—	—
Beddoe and Murphy, 2004 <sup>35</sup>	MBSR	16	Nursing students	8	UCT	DSP	n.c.	—	—
Cohen-Katz, 2005 <sup>36</sup>	MBSR/waiting list	12/13	Nurses	8 weeks; 3-month follow-up	RCT	BSI	n.c.	MAAS	1.959/0.787
Shapiro, 2005 <sup>29</sup>	MBSR/waiting list	10/18	Health care professionals	8	RCT	PSS	1.724/-0.303	—	—
Shapiro, 2007 <sup>30</sup>	MBSR/weekly meetings	22/32	Therapists in training	10	CT	PSS	1.008/-0.162	MAAS	0.372/-0.396
Jain, 2007 <sup>31</sup>	MBSR/relaxation training/waiting list	27/24/30	Medical students, graduate nursing students, undergraduate premed students	4	RCT AC	BSI	1.366/0.911/ 0.272	INSPIRIT-R	0.066/0.074/ -0.027
Klatt, 2008 <sup>32</sup>	MBSR/waiting list	22/20	Faculty and staff at a large midwestern university	6	RCT	PSS	2.858/-0.47	MAAS	1.929/0.193
Vieten and Astin, 2008 <sup>33</sup>	MBSR/waiting list	13/18	Pregnant women between 12 and 30 weeks gestation	10 weeks; 3 month follow-up	RCT	PSS	0.776/0.041	MAAS	0.253/-0.308

NC, not calculable; MBSR, mindfulness-based stress reduction; UCT, uncontrolled trial; RCT, randomized controlled trial; SS-CT, self selected controlled trial; RCT AC, randomized controlled trial with an active control; CT AC, controlled trial with an active control; GSI, global severity index (of the Hopkins Symptom Checklist 90 Revised); POMS, profile of mood symptoms; DSP, Derogatis stress profile; BSI, brief symptom inventory; PSS, perceived stress scale; INSPIRIT, index of core spiritual experiences; MAAS, mindfulness attention awareness scale; INSPIRIT-r, index of core spirituality-revised.

TABLE 2. ASSESSMENT OF STUDY QUALITY OF CONTROLLED TRIALS

Study	Randomization	Appropriate randomization	Dropouts and withdrawals	Blinding	Appropriate blinding	Jadad score
Astin, 1997 <sup>34</sup>	Yes	Unclear	Yes	No	—	2
Shapiro, 1998 <sup>27</sup>	Yes	Unclear	No	No	—	1
Rosenzweig, 2003 <sup>28</sup>	No	—	No	No	—	0
Cohen-Katz, 2005 <sup>36</sup>	Yes	Unclear	No	No	—	1
Shapiro, 2005 <sup>29</sup>	Yes	Unclear	Yes	No	—	2
Shapiro, 2007 <sup>30</sup>	No	—	No	No	—	0
Jain, 2007 <sup>31</sup>	Yes	Yes	Yes	No	—	3
Klatt, 2008 <sup>32</sup>	Yes	Unclear	No	No	—	1
Vieten and Astin, 2008 <sup>33</sup>	Yes	Unclear	Yes	No	—	2

Statistical analysis was performed on the completers' samples, in accord with data provided by the authors. Furthermore, when studies included in the analysis failed to report the standard deviation, it was imputed as the weighted average from other studies included in the present review that employed the same scale.<sup>26</sup> Data that could not be aggregated in the main outcome measures and data defined as secondary outcome measures were reviewed in a narrative way.

## Results

### MBSR for the reduction of stress

Comparison between MBSR and inactive treatment. Data from 7 controlled and randomized controlled studies could be aggregated.<sup>27-33</sup> From the comparison between the Cohen's *d* of measures of stress, we found that MBSR had a significant positive nonspecific effect compared to the absence of any treatment (waiting list) (Table 4). The results were maintained even when randomized controlled trials were analyzed separately. Results from a single controlled trial comparing MBSR to a control group intervention designed to be structurally equivalent to meditation program in terms of instructor attention, weekly and total duration, and course modality (both were group-based),<sup>30</sup> suggested that MBSR could have a specific effect as well ( $p=0.001$ ).

Three further studies reported measures of stress. In the first study, investigating the possibility of a standard course of MBSR to reduce stress in university undergraduates, a significantly higher reduction of stress from baseline, as measured by the global severity index of the Hopkins Symptom Checklist 90 Revised (SCL-90), was observed in the MBSR group compared to the group on the waiting list (64% versus 14%;  $p < 0.002$ ).<sup>34</sup> Significant improvements were noticed in many subscales of the SCL-90 as well, including measures of depression, anxiety, obsessive compulsive symptoms, somatization, interpersonal sensitivity, psychoticism, and paranoid ideation ( $p < 0.05$  for all). A following open label study confirmed this data, finding a significant stress reduction from

baseline ( $p < 0.05$ ) in 16 female nursing students practicing MBSR, even though the open label design as well as the self-selection of participants limited the significance of these findings.<sup>35</sup>

On the other hand, no significant difference was noticed between improvements in severe stress in the MBSR group compared to the control group in the study by Cohen-Katz and colleagues.<sup>36</sup> However, the study failed to consider global stress values, focusing only on those affected by severe distress and specifying that the instrument used for the assessment of stress might not be sensitive enough.

Comparison between MBSR and active treatment. In the only study investigating this parameter, the *t*-test did not show any significant difference between the two treatments ( $p > 0.05$ ).<sup>31</sup>

In conclusion, evidence supports the positive nonspecific effect of MBSR on stress reduction in healthy people, highlighting a possible specific effect, and suggesting that MBSR is similar to relaxation training in terms of stress reduction.

### MBSR for the enhancement of spirituality

Comparison between MBSR and inactive treatment. Data from 5 controlled and randomized controlled studies could be aggregated.<sup>30-33,36</sup> From the comparison between the Cohen's *d* of spirituality measures, we found that MBSR was significantly more efficacious in enhancing spirituality than the inactive control. Even excluding the non-randomized controlled study, the results did not change. Separate analysis of effect size on the index of core spiritual experiences (INSPIRIT) and mindfulness attention awareness scale (MAAS) yielded similar results ( $p=0.0001$  and  $p=0.0000001$ , respectively).

Significant enhancement in spirituality values, as measured by INSPIRIT, has been reported by Astin in the group practicing MBSR,<sup>34</sup> and this enhancement was found to be significantly higher in the group of meditators compared to

TABLE 3. ASSESSMENT OF STUDY QUALITY OF OPEN LABEL TRIAL

Study	Representativeness	Comparison group	Outcome assessment	Adequate follow-up	NOS score
Beddoe and Murphy, 2004 <sup>35</sup>	No (nurses and females only)	No comparison group	No (self-report)	No	0

NOS, Newcastle-Ottawa scale.

TABLE 4. COMPARISON OF THE COHEN'S *D* OF MEASURES OF STRESS BETWEEN MINDFULNESS-BASED STRESS REDUCTION (MBSR) GROUPS AND CONTROLS

Measure	Analysis	MBSR	Control	t	p
Stress	Global analysis	0.743 ± 0.77	-0.208 ± 0.21	21.01	< 0.001
	RCT	1.387 ± 0.83	-0.048 ± 0.25	18.18	< 0.001
Spirituality	Global analysis	0.824 ± 0.83	-0.043 ± 0.37	9.95	< 0.000001
	RCT	0.959 ± 0.91	0.095 ± 0.35	7.92	< 0.000001

RCT, randomized controlled trial. Figures shown as mean ± standard deviation.

the control group in the first study performed by Shapiro and colleagues using the same scale.<sup>27</sup>

Comparison between MBSR and active treatment. For the only study that investigated spirituality through INSPIRIT, the *t*-test did not show any significant difference between the two treatments ( $p > 0.05$ ).<sup>31</sup> No direct comparison between different active treatments on MAAS scores is available.

MBSR practice was related to a significant increase in spirituality values which were comparable, although not superior, to a further comparison active treatment.

#### *Do decreases of stress correlate with enhancement in spiritual values?*

In an early study, no significant association between increases in spirituality levels and improvements in stress was found.<sup>34</sup> However, later analysis consistently reported an association between these two parameters. In particular, Beddoe and Murphy found a significant correlation between time spent in a mindfulness attitude and greater ability to face stressful situations.<sup>35</sup> Furthermore, Shapiro and colleagues reported that enhancement in mindfulness levels, as measured with MAAS, significantly correlated with a reduction in perceived stress, rumination, trait anxiety, and an increase in levels of self-compassion.<sup>29</sup> Finally, Shapiro and colleagues, correlating many analyzed measures, proposed a mechanism through which MBSR was found to be efficacious: compliance with treatment reduced trait anxiety, and this reduction was both associated with a reduction in state anxiety and a reduction of depressive symptoms, further related to a reduction of stress.<sup>27</sup> Moreover, state anxiety was also inversely correlated to spirituality levels. Thus, there is scarce and sometimes contrasting evidence about the relationship between changes in perceived stress and changes in spirituality levels, possibly related to small sample sizes and to the use of different scales for the measurement of stress and spirituality. Actual findings suggest that there could be important correlations, either direct or indirect, and underline the necessity for further research in this area.

#### *Are results obtained in the short term maintained in the long term?*

There is little evidence whether the benefits obtained through standardized courses of MBSR are consistently maintained in the long term. In particular, while first studies showed that the benefits were maintained in a significant number of subjects at 3-month follow-up,<sup>34,36</sup> a significant decrease in the improvements gained at the 10th week was noticed at the 3-month follow-up in a sample of pregnant

women, although there was a trend for improvement from pre-test values was maintained.<sup>33</sup> A possible reason for this finding could be the increase of stress during the last part of pregnancy or immediately after birth. Nonetheless, the scarcity of data and the small sample size of included samples underline the necessity for further investigations.

#### *MBSR and rumination*

MBSR, which teaches to observe thoughts nonjudgmentally and put the focus on the present moment, is supposed to reduce ruminative thinking.<sup>5,37</sup> Two studies<sup>30,31</sup> focused on this parameter in healthy subjects. In the first study, the authors observed a significant decrease in ruminative thoughts from baseline, as measured with the Reflection Rumination Questionnaire<sup>13</sup> in the MBSR group (from 3.42 to 2.78) whereas no differences were noted in the control group (3.15 to 3.11). These results were confirmed in the study performed by Jain and colleagues, as shown by reports on daily diaries (MBSR group, 3.9 to 2.5; control group, 3.5 to 4.4): furthermore, the decrease of ruminative thinking was significantly greater in the MBSR group compared to the relaxation training group, suggesting a possible advantage of MBSR in comparison to pure relaxation.<sup>31</sup>

#### *MBSR, empathy, and self-compassion*

Empathy was defined by Rogers as the capacity to understand, be sensitive to, and feel what another is feeling as well as the ability to communicate this sensitivity to the person.<sup>38</sup> In a first study, MBSR was found to significantly increase empathy from baseline in 16 nursing students ( $p < 0.05$ ) as measured with interpersonal reactivity index.<sup>39</sup> These results were later confirmed in a sample of university undergraduates investigated by Shapiro et al.,<sup>27</sup> as measured with the Empathy Construct Rating Scale.<sup>40</sup>

Moreover, MBSR was found to be efficacious for enhancing self-compassion levels as well. Shapiro and colleagues<sup>32</sup> found significant increases in self-compassion, as measured with a self-compassion scale<sup>41</sup> in the group that practiced MBSR (23%) in comparison to the waiting list group (7%) ( $p < 0.004$ ), a result replicated in a following study performed on psychotherapists in training, in which  $p$  was  $< 0.0001$ .<sup>30</sup>

#### *MBSR and further measures*

Significant improvements were noticed as well on the state and trait anxiety levels, as measured with the State and Trait Anxiety Index<sup>42</sup> in 2 randomized controlled studies<sup>27,30</sup> in groups that practiced MBSR, whereas no significant difference was found in the waiting list groups. In the study performed by Beddoe and Murphy, 63% of participants

reported improvements in personal relationships, 75% in self-confidence, and 69% reported being more assertive after the course.<sup>35</sup> Astin reported that an MBSR course was followed by a significant increase in self-control,<sup>34</sup> and significant improvements were noticed in sleep quality in the study performed by Klatt and colleagues.<sup>32</sup> One study investigated whether self-report measures could be biased by social desirability,<sup>31</sup> a tendency to respond in a socially desirable manner, as measured by the Marlowe-Crowne Social Desirability Scale; the results of this study showed that no significant bias due to social desirability could be found.<sup>43</sup>

## Discussion

The aim of the present work was to review current evidence about the efficacy of MBSR on stress reduction in healthy subjects. Reviewed findings consistently showed that MBSR provided a significant nonspecific effect on reduction of stress levels in comparison with no treatment (waiting list) in healthy subjects. Our results support the notion that MBSR could have a significant specific effect as well, as shown by a study comparing MBSR to a nonspecific treatment designed to be structurally equivalent to a meditation program in terms of instructor attention, weekly and total duration, and course modality.<sup>30</sup> Unfortunately, however, it is still not possible to argue which is the specific "active ingredient" of MBSR, in particular if it is the often-claimed "mindfulness" itself, because MBSR is a multimodal program that involves many active components in addition to mindfulness meditation.

Our results were in accord with other studies performed on groups of healthy subjects who practiced MBSR courses as well as other mindfulness meditations, such as *Vipassana* meditation. In a study focusing on a standard 10-day retreat of *Vipassana* meditation,<sup>44</sup> significant decreases in stress levels were found 3 months after the course in a sample of 53 subjects ( $p < 0.001$ ). Furthermore, a following study focusing on both MBSR and concentrative meditation reported a significant reduction in stress values in groups of healthy meditators compared to controls.<sup>45</sup> The study grouped together participants of both groups of meditation so it could not be included in our analysis. Nonetheless, it provides further evidence that meditation can reduce stress in healthy subjects.

Given the consistent limitations of actual studies, there is still a need for rigorous, properly powered, randomized controlled studies to determine the magnitude of the effects of MBSR on stress reduction in healthy subjects, to better establish possible specific effects of MBSR in comparison to control interventions providing nonspecific support, and to investigate possible predictors of response to this kind of meditation.

A further area of investigation should focus on the long-term effects of MBSR on stress in healthy subjects, for example including follow-up of one or more years, or investigating long-term practitioners. Actual evidence about long-term effects of MBSR in healthy people to date ends at 3-month follow-up and shows contrasting findings. Some sparse evidence suggests that significant improvements after the 8-week program could be maintained in the long-term, as shown by Miller et al., who found that improvements gained in anxiety and depression symptoms were maintained 3 years after the practice in a sample of patients suffering from generalized anxiety disorder and panic disorder.<sup>46</sup> Long-term follow-up

would be particularly important considering that participants in MBSR groups usually continue to practice after the course.<sup>34,46</sup>

A second important finding was that MBSR significantly enhanced spirituality levels in comparison to an inactive control but not in comparison to an active control, although there is not, to date, a clear and shared model that correlates increases in spirituality and decreases in perceived stress. Results on both stress reduction and spirituality enhancements were observed in randomized controlled trials even when considered separately in order to reduce potential confounding factors as self-selection bias. Furthermore, separate analysis of scores on two different scales used to assess spirituality—INSPIRIT, which investigates the relationship between the individual and a "higher power," and MAAS, which focuses on a particular attitude towards present experience characterized by openness, curiosity, and awareness—yielded similar results.

Our findings suggest that MBSR can be significantly superior to a relaxation program in reducing ruminative thinking as well. Further improvements in many psychological features (decreases in trait anxiety, increases in empathy and self-compassion) suggest that MBSR could be associated to nonspecific improvements of many psychological symptoms other than stress, although no specific effect can yet be shown. Overall, our findings are in accord and extend previous findings about different types of meditative practices, including mindfulness meditations in general.<sup>6,47</sup> On the other hand the low quality of the majority of studies confirms the problem proposed by Carpenter, who noted the scarcity of well-designed studies on meditation and underlined the necessity for higher quality design of future studies.<sup>48</sup>

Many limitations affect the present findings. The majority of included studies were of low quality. This could result in potential undetected biases that reduce the significance of reviewed findings. The main methodological shortcomings were small sample size, self-selection, nonrandomization, and the impossibility of conducting meditation studies under a double blind condition. However, 9 of 10 studies, including the only high quality study,<sup>31</sup> provided significant results in the same direction, and the analysis focusing separately on the randomized controlled trial provided significant findings as well, underlying the nonspecific and potentially specific effect of MBSR for stress reduction.

A second limitation regards the use of a waiting list that fails to control for nonspecific factors such as group support or a teacher's care in a control group. Nonetheless, MBSR showed similar results when compared to another active treatment in a study directly comparing these two treatments and was significantly more efficacious than didactic seminars used to control for these nonspecific factors in a further study.<sup>30</sup>

A third limitation is the administration of self-rated scales which could be influenced by social desirability. However, a single study controlling for this factor did not detect any influence of social desirability on final outcome measures.

A fourth limitation was that people in all studies were most often females, Caucasian, and undergraduate students, thus limiting the generalizability to males, non-Caucasians, and older adults, and enhancing the necessity of further research in more representative samples.

A further limitation is represented by the decision to group together different measures of spirituality as an overall sense

of connection with something greater, or transcendent, or with present experience; although we performed analysis for MAAS and INSPIRIT values separately as well. Establishing the differences and the possible connections between these facets of “transcendence” could be an important challenge for future studies.

An important final limitation is the differing durations of the studies and partially differing study designs, which could influence final values. Nonetheless, apart from the modified version for workers<sup>35</sup> and the shortened program for students who were facing the examination period,<sup>34</sup> MBSR techniques, programs, and lessons/home practice duration were not significantly different across the studies.

## Conclusions

Current evidence suggests that MBSR has both a non-specific and possibly a specific effect on stress reduction in healthy subjects. Further research is needed to investigate larger and more heterogeneous samples, to assess efficacy measures in the long term, and to better establish specific effects of this particular meditation program.

## Disclosure Statement

The authors state that no competing financial interests exist.

## References

- Kabat-Zinn J. *Full Catastrophe Living: Using the Wisdom of your Body and Mind to Face Stress, Pain and Illness*. New York: Dell Publishing, 1990.
- Kabat-Zinn J. Mindfulness-based stress reduction (MBSR). *Constructiv Hum Sci* 2003;8:73–107.
- Kabat-Zinn J. An outpatients program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Preliminary considerations and preliminary results. *Gen Hosp Psych* 1982;4:33–47.
- Kabat-Zinn J, Lipworth L, Burney R. The clinical use of mindfulness meditation for the self-regulation of chronic pain. *J Behav Med* 1985;8:163–190.
- Bishop SR, Lau M, Shapiro S. Mindfulness: A proposed operational definition. *Clin Psych* 2004;11:230–241.
- Bishop SR. What do we really know about mindfulness-based stress reduction? *Psychosom Med* 2002;64:71–83.
- Proulx K. Integrating mindfulness-based stress reduction. *Holist Nurs Pract* 2003;17:201–208.
- Praissman S. Mindfulness-based stress reduction: A literature review and clinician’s guide. *J Am Acad Nurse Pract* 2008;20:212–216.
- Kiyota M, Jones EW, eds. *Mahayana Buddhist Meditation: Theory and Practice*. Honolulu: Hawaii University Press, 1978.
- Buddhaghosa B. *Vissuddhimagga* (The Path of Purification). Seattle: Shambala, 1976.
- Kabat-Zinn J. *Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life*. New York: Hyperion, 1994.
- Marlatt GA, Kristeller JL. Integrating spirituality into treatment: Resources for practitioners. In: Miller WR, ed. *Mindfulness and Meditation*. Washington, DC: American Psychological Association, 1999.
- Trapnell PD, Campbell JD. Private self-consciousness and the five-factor model of personality: Distinguishing rumination from reflection. *J Pers Soc Psychol* 1999;76:284–304.
- Ong AD, Bergeman CS, Bisconti TL, et al. Psychological resilience, positive emotions, and successful adaptation to stress in later life. *J Pers Soc Psychol* 2006;91:730–749.
- Fergus S, Zimmerman MA. Adolescent resilience: A framework for understanding healthy development in the face of risk. *Annu Rev Public Health* 2005;26:399–419.
- Haglund ME, Nestadt PS, Cooper NS, et al. Psychobiological mechanisms of resilience: Relevance to prevention and treatment of stress-related psychopathology. *Dev Psychopathol* 2007;19:889–920.
- Lopez S, Snyder C, Pedrotti J. Hope: Many definitions, many measures. In: Lopez S, Snyder C, eds. *Positive Psychology Assessment: A Handbook of Models and Measures*. Washington, DC: American Psychological Association, 2003:91–106.
- Harris A, Thoresen C. Forgiveness, unforgiveness, health and disease. In: Worthington E, ed. *Handbook of Forgiveness*. New York: Routledge, 2005:321–334.
- Schneiderman N, Ironson G, Siegel SD. Stress and health: Psychological, behavioral, and biological determinants. *Annu Rev Clin Psychol* 2005;1:607–628.
- Selye H. Stress and disease. *Science* 1955;122:625–631.
- McEwen BS. Protective and damaging effects of stress mediators. *N Engl J Med* 1998;338:171–179.
- Baer RA, Smith GT, Hopkins J, et al. Using self-report assessment methods to explore facets of mindfulness. *Assessment* 2006;13:27–45.
- Jadad AR, Moore RA, Carroll D. Assessing the quality of reports of randomized clinical trials: Is blinding necessary? *Control Clin Trials* 1996;17:1–12.
- Wells GA, Shea B, O’Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analysis. Document available at [www.ohri.ca/programs/clinical\\_epidemiology/oxford.htm](http://www.ohri.ca/programs/clinical_epidemiology/oxford.htm). Accessed March 4, 2009.
- Rosnow R, Rosenthal R. Computing contrasts, effect sizes and counternulls on other people’s published data: General procedures for research consumers. *Psychol Meth* 1996;1:331–340.
- Furukawa TA, Barbui C, Cipriani A, et al. Imputing missing standard deviations in meta-analyses can provide accurate results. *J Clin Epidemiol* 2006;59:7–10.
- Shapiro SL, Schwartz GE, Bonner G. Effects of mindfulness-based stress reduction on medical and premedical students. *J Behav Med* 1998;21:581–599.
- Rosenzweig S, Reibel DK, Greeson JM, et al. Mindfulness-based stress reduction lowers psychological distress in medical students. *Teach Learn Med* 2003;15:88–92.
- Shapiro S, Astin J, Bishop SR, et al. Mindfulness-based stress reduction for health care professionals: Results from a randomized trials. *Int J Stress Man* 2005;12:164–176.
- Shapiro S, Brown KW, Biegel G. Teaching self-care to caregivers: Effects of mindfulness-based stress reduction on the mental health of therapists in training. *Train Educ Prof Psychol* 2007;1:105–115.
- Jain S, Shapiro SL, Swanick S, et al. A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. *Ann Behav Med* 2007;33:11–21.
- Klatt MD, Buckworth J, Malarkey WB. Effects of low-dose mindfulness-based stress reduction (MBSR-ld) on working

- adults. *Health Educ Behav* 2008 May 9 [epub ahead of print].
33. Vieten C, Astin J. Effects of a mindfulness-based intervention during pregnancy on prenatal stress and mood: Results of a pilot study. *Arch Womens Ment Health* 2008;11:67–74.
  34. Astin JA. Stress reduction through mindfulness meditation. Effects on psychological symptomatology, sense of control, and spiritual experiences. *Psychother Psychosom* 1997;66:97–106.
  35. Beddoe AE, Murphy SO. Does mindfulness decrease stress and foster empathy among nursing students? *J Nurs Educ* 2004;43:305–312.
  36. Cohen-Katz J, Wiley SD, Capuano T, et al. The effects of mindfulness-based stress reduction on nurse stress and burnout: A qualitative and quantitative study. *Hol Nurs Pract* 2005;19:26–35.
  37. Teasdale JD, Segal ZV, Williams JMG. Mindfulness training and problem formulation. *Clin Psychol* 2003;10:157–160.
  38. Rogers C. *On Becoming a Person*. Boston: Houghton Mifflin, 1961.
  39. Davis M. A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology* 1980;10:85. Document available at [www.eckerd.edu/academics/psychology/files/Davis\\_1980.pdf](http://www.eckerd.edu/academics/psychology/files/Davis_1980.pdf) Accessed March 4, 2009.
  40. La Monica EL. Construct validity of an empathy instrument. *Res Nurs Health* 1981;4:389–400.
  41. Neff K. The development and validation of a scale to measure self-compassion. *Self and Identity* 2003;2:223–250.
  42. Spielberger C. *State-Trait Anger Expression Inventory*. Odessa, FL: Psychological Assessment Resources, 1991.
  43. Reynolds W. Development of reliable and valid short forms of the Marlowe-Crowne Social Desirability Scale. *J Clin Psychol* 1982;38:119–125.
  44. Ostafin BD, Chawla N, Bowen S, et al. Intensive mindfulness training and the reduction of psychological distress: A preliminary study. *Clin Behav Pract* 2006;13:191–197.
  45. Oman D, Shapiro SL, Thoresen CE, et al. Supports forgiveness among college students: A randomized controlled trial. *J Am Col Health* 2008;56:569–578.
  46. Miller JJ, Fletcher K, Kabat-Zinn J. Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders. *Gen Hosp Psych* 1995;17:192–200.
  47. Ospina MB, Bond K, Karkhaneh M, et al. Meditation practices for health: State of the research. *Evid Rep Technol Assess (Full Rep)* 2007:1–263.
  48. Canter PH. The therapeutic effects of meditation. *BMJ* 2003;326:1049–1050.

Address reprint requests to:  
*Alberto Chiesa, M.D.*  
*Institute of Psychiatry*  
*University of Bologna*  
*Viale Carlo Pepoli 5*  
*40123 Bologna*  
*Italy*

*E-mail: albertopnl@yahoo.it*