

A Pilot Study Comparing the Effects of Mindfulness-Based and Cognitive-Behavioral Stress Reduction

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ABSTRACT

Objectives: The objective of this pilot study was to compare the effects of two mind–body interventions: mindfulness-based stress reduction (MBSR) and cognitive-behavioral stress reduction (CBSR).

Subjects: Fifty (50) subjects were recruited from the community and took part in MBSR (n = 36) and CBSR (n = 14) courses. Participants self-selected into MBSR or CBSR courses taught at different times. There were no initial differences between the MBSR and CBSR subjects on demographics, including age, gender, education, and income.

Intervention: MBSR was an 8-week course using meditation, gentle yoga, and body scanning exercises to increase mindfulness. CBSR was an 8-week course using cognitive and behavioral techniques to change thinking and reduce distress.

Design: Perceived stress, depression, psychological well-being, neuroticism, binge eating, energy, pain, and mindfulness were assessed before and after each course. Pre–post scores for each intervention were compared by using paired *t* tests. Pre–post scores across interventions were compared by using a general linear model with repeated measures.

Settings/Locations: Weekly meetings for both courses were held in a large room on a university medical center campus.

Results: MBSR subjects improved on all eight outcomes, with all of the differences being significant. CBSR subjects improved on six of eight outcomes, with significant improvements on well-being, perceived stress, and depression. Multivariate analyses showed that the MBSR subjects had better outcomes across all variables, when compared with the CBSR subjects. Univariate analyses showed that MBSR subjects had better outcomes with regard to mindfulness, energy, pain, and a trend for binge eating.

Conclusions: While MBSR and CBSR may both be effective in reducing perceived stress and depression, MBSR may be more effective in increasing mindfulness and energy and reducing pain. Future studies should continue to examine the differential effects of cognitive behavioral and mindfulness-based interventions and attempt to explain the reasons for the differences.

INTRODUCTION

Mind–body medicine focuses on the interaction of the brain, mind, and body and how these interactions affect health. Mind–body interventions include cognitive-behavioral therapy (CBT), meditation, relaxation, visual im-

agery, yoga, biofeedback, t'ai chi, qi gong, group support, and spirituality.¹ While CBT is the most researched of all mind–body interventions, a meditation approach, called mindfulness-based stress reduction (MBSR), is receiving increasing interest and study.^{2,3} CBT is rooted in Western psychology and medicine and focuses on changing thoughts and

feelings. MBSR draws upon Eastern Buddhist traditions and emphasizes the acceptance of the full range of one's inner experience. Our goal was to provide a comparison of the effects of CBT and MBSR on a variety of health outcomes.

Cognitive-behavioral approaches

Cognitive behavioral approaches are based on the theory that cognitions, emotions, and behavior interact, and that cognitions influence our emotions and behavior.⁴⁻⁷ A primary goal of CBT is to enable people to replace "irrational," "unrealistic," or "illogical" thoughts with thoughts that are more "rational," "realistic," or "logical." The idea is that improved thinking will lead to fewer distressing emotions and less maladaptive behavior. This may also decrease the stress response and improve health behaviors, resulting in better physical health outcomes.^{8,9} CBT also uses behavioral techniques, such as relaxation exercises, to try to reduce stress and emotional distress.

CBT interventions have been associated with improvement on a variety of health-related outcomes. Butler et al.¹⁰ examined 16 meta-analyses of the effects of CBT and found improvements on a variety of problems, including major depression, generalized anxiety disorder, and post-traumatic stress disorder. There is also evidence that cognitive-behavioral interventions may be effective in treating or improving quality of life for irritable bowel syndrome,¹¹ chronic fatigue syndrome,¹² substance dependence,¹³ and in improving quality of life and immune function for cancer patients.¹⁴

MBSR

MBSR was adapted from the Buddhist practice of mindfulness meditation by Jon Kabat-Zinn to enable people to better cope with illness, stress, and pain.¹⁵ The standardized MBSR group intervention aims at increasing mindfulness through meditation, body scans, gentle Hatha yoga, and group discussion. In a recent meta-analysis of 20 studies, MBSR was related to better outcomes in participants dealing with a variety of stressors and health problems.³ In both controlled and uncontrolled studies, MBSR was related to reductions in stress,¹⁶ depression,¹⁷ fatigue,¹⁸ pain,¹⁹ and binge eating.²⁰

Increasing mindfulness is a central goal of MBSR and may be helpful in explaining its beneficial effects. Brown and Ryan² have defined mindfulness as consciously attending to one's moment-to-moment experience. They have developed an instrument to measure it, called the Mindfulness Attention Awareness Scale (MAAS).² Shapiro et al.²¹ have proposed that mindfulness involves three things: the intention to practice mindfulness, attention to the present moment, and an attitude of kind, open acceptance of all experiences. They contend that the integration of this intention, attention, and attitude facilitates a fundamental shift in perspective that they called "reperceiving."

Comparing CBT and MBSR

While cognitive-behavioral and mindfulness approaches encourage becoming aware of thoughts and feelings, there are important differences in what one is asked to do with them. CBT encourages judging the extent to which thoughts are rational, realistic, or logical,⁴⁻⁷ and MBSR encourages the acceptance of all thoughts and feelings without judgment.^{15,22} While the goal of CBT is to replace thoughts that are irrational, unrealistic, or illogical, the goal of MBSR is simply to nonjudgmentally observe thoughts and feelings as they come and go.

The reputed mechanisms of change for CBT and MBSR parallel these differences. CBT is thought to increase rational, realistic, or logical thinking, which, in turn, is thought to reduce distress and the maladaptive behaviors.⁴⁻⁷ Mindfulness-based approaches are thought to enable a person to "reperceive" their experience in a less judgmental, more kind, and accepting manner.^{15,22} This reperception may facilitate self-regulation, coping flexibility, values clarification, and a form of exposure that may result in reduced stress and distress.²¹

The current study

The aim of this study was to provide a preliminary comparison of MBSR and CBT approaches. Before conducting a randomized trial, we wanted to do a pilot study examining the effect size of comparable MBSR and CBT interventions on a range of outcomes.²³ Thus, we conducted an observational study of those who self-selected into matched MBSR and CBT courses. Our hypotheses were that both MBSR and CBT interventions would result in decreased perceived stress and depression, and that MBSR would be associated with increased mindfulness. We made no additional predictions about differences between the interventions.

MATERIALS AND METHODS

Subjects

The subjects were recruited from the Albuquerque, New Mexico, metropolitan area through university intranet, primary care referrals, and local newspaper ads. They self-selected into MBSR and matched CBT-based stress reduction that we call cognitive-behavioral stress reduction (CBSR). These courses were taught at different times over a 1.5-year period. The MBSR course was advertised as a "stress reduction class" that used a blend of meditation and gentle yoga to help people deal with stress. The CBSR course was advertised as a "stress management class" teaching strategies to help identify stressful situations and respond to them in a more relaxed, stress-free way. The inclusion criterion was the willingness to commit to the course and the research study. The exclusion criteria were severe acute mood disorder, psychosis, and substance abuse.

Sixty-four (64) subjects began the interventions (MBSR = 45 and CBSR = 19) and 50 subjects completed them (MBSR = 36 and CBSR = 14). There was no significant difference in the proportion of completers between the MBSR and CBSR subjects. Further, the completers and non-completers did not differ in age, gender, income, and education. The cost of the MBSR course was \$195, and the cost of the CBSR course was \$70. All participants were given a \$20 discount on the price of the course for participating in the research.

Procedure

MBSR course. The intervention was a modified MBSR course taught by two professionally trained MBSR instructors on the faculty at the UNM Health Sciences Center (an MD in integrative medicine and a PhD in occupational therapy). The course closely paralleled the MBSR curriculum developed at the University of Massachusetts Medical Center and included a 6-hour 1-day retreat during the 6th week of the course. Everyone in the course always met as one large group, with both instructors present at all times. The weekly sessions were 3 hours long and aimed at increasing mindfulness awareness and attention through the use of breathing, body scans, meditation, gentle Hatha yoga, and group discussion. The only significant modification to the standard MBSR course was additional exercises (about 10 minutes long, each week) focusing on eating involving the mindful tasting and eating of healthy and unhealthy foods.

CBSR course. The course was taught by two professionally trained and supervised instructors (professionally supervised PhD clinical psychology graduate students). As with the MBSR course, everyone in the course always met as one large group and both instructors were present at all times. While there was no full-day retreat, the weekly sessions were 3 hours long and included the teaching of cognitive-behavioral stress management skills. The primary skills taught were cognitive restructuring skills and behavioral relaxation techniques. The cognitive restructuring skills involved learning to identify “irrational” thoughts and trying to replace them with more “rational” thoughts. The relaxation techniques included deep breathing, progressive muscle relaxation, and guided visualization and focused on reducing distress.

While the interventions were matched on the use of discussion, the use of practicing techniques, and the request that participants practice between weekly sessions, the critical difference was the focus on accepting thoughts and feelings in the MBSR course and the focus on changing thoughts and feelings in the CBSR course. The MBSR course attempted to cultivate nonjudgmental moment-to-moment attention to, awareness of, and ongoing observation of one’s inner experience. The CBSR course attempted to enable subjects to replace “irrational” thoughts with “rational”

thoughts, using cognitive techniques and reduce distressing feelings using behavioral relaxation techniques. The concept of mindfulness was not mentioned.

Measures

A questionnaire was administered within the week before the start of the course and within 1 week after the end of the course. The questionnaire assessed demographics, mindfulness, and several aspects of psychologic and physical health. All measures listed below were included both the pre- and postquestionnaires. Cronbach’s alphas for the pretests are presented for the 50 participants who completed the courses.

Binge eating. The Binge Eating Scale (BES) assesses the severity of binge eating and the uncontrolled consumption of a large amount of food.²⁴ The BES includes 16 items scored on a 4-point scale (e.g., 1 = “I feel capable to control my eating urges when I want to” to 4 = “Because I feel so helpless about controlling my eating I have become very desperate about trying to get in control.”). Cronbach’s alpha was 0.917.

Depressive symptoms. The Beck Depression Inventory II (BDI-II) was used to assess depressive symptoms over the previous 2 weeks.^{25,26} There are 21 items (e.g., Sadness: 0 = “I do not feel sad,” 1 = “I feel sad much of the time,” 2 = “I am sad all the time,” and 3 = “I am so sad or unhappy that I can’t stand it”) scored on a 4-point scale. Cronbach’s alpha was 0.868.

Energy level. The participant’s average daily energy level was measured by using a visual analog scale. Participants were asked to place an “X” on a line 100 mm long to indicate “where your average daily energy level is currently” (0 = “no energy” and 100 = “highest energy”).

Mindful awareness and attention. The MAAS is a measure of receptive awareness of, and attention to, present-moment events and experience.² The MAAS includes 15 reverse scored items (e.g., “I feel it difficult to stay focused on what’s happening in the present”) scored on a 6-point scale (1 = almost never to 6 = almost always). Cronbach’s alpha was 0.917.

Neuroticism. Neuroticism was assessed by using the eight items from a measure of the Big Five personality factors.²⁷ Participants are asked how much they agree with the items (e.g., “can be tense” and “can be moody”) on a 5-point scale (1 = strongly distress to 5 = strongly agree). Cronbach’s alpha was 0.831.

Pain level. The participant’s average daily level of pain was measured by using a visual analog scale. Participants

were asked to place an “X” on a line 100 mm long to indicate “where your average daily pain level is currently” (0 = “no pain” and 100 = “highest pain”).

Perceived stress. The Perceived Stress Scale (PSS) was used to assess perceived stress.²⁸ The PSS consists of 10 items (e.g., “How often have you found that you could not cope with all the things that you had to do?”) that are scored on a 5-point scale (0 = never to 4 = very often). Cronbach’s alpha was 0.902.

Psychological well-being. The Scales of Psychological Well-Being (SPWB) was used to assess psychologic well-being.²⁹ There are 18 items for each scale (e.g., “When I look at the story of my life, I am pleased with how things have turned out”) scored on a 6-point scale (1 = strongly disagree to 6 = strongly agree). Cronbach’s alpha was 0.789.

RESULTS

Table 1 displays the breakdown for age, gender, income, and education for each of the MBSR and CBSR courses. There were no significant differences between the MBSR and CBSR groups in age, gender, education, or income. The mean age of subjects 44.94 years ($SD = 13.72$) and subjects were 80% female. The mean level of education was 4 years of college and the mean range of income was \$50,000–\$74,999.

We examined the preintervention scores on mindfulness, perceived stress, and each of the psychologic and general health measures. These scores are displayed as the “pre” scores in Table 2 for the MBSR group and Table 3 for the CBSR group. The only significant between-group differences on these measures was that the CBSR participants had higher mindfulness scores than the MBSR participants ($t[48] = -2.163$; $p < 0.05$). There were no individual participants with outliers of three standard deviations or more from the sample mean on any of these variables.

The BDI was used to characterize the initial mental health of the overall sample because it has standard cut-offs for “minimal depression” (0–13), “mild-moderate depression” (14–19), “moderate-severe depression” (20–28), and “severe depression” (29–63).²⁶ These ranges were examined by using the combined groups because there was no difference in mean BDI scores. The overall sample mean ($M = 11.85$, $SD = 7.42$) was slightly below the 13.5 cutoff for mild-moderate depression. Using all the cut-offs, 22 participants were minimally depressed, 21 were moderately-severely depressed, 7 were moderately-severely depressed, and none were severely depressed.

Next, we conducted paired t tests to compare the pre- and postintervention in the MBSR and then the CBSR participants. In the MBSR group, there were significant changes

on all eight variables (see Table 2). There were significant increases in mindfulness, well-being, and energy and significant decreases in perceived stress, depression, neuroticism, binge eating, and pain. In the CBSR group, there were significant changes in three of the eight variables (see Table 3). There was a significant increase in well-being and significant decreases in perceived stress and depression.

Next, we examined the effect sizes for the pre–post changes. Table 4 displays the Cohen’s d scores for these changes in the MBSR and CBSR groups. Cohen’s d are listed as positive if there was a change in desired direction (e.g., less depression, more well-being) and negative if there was a change in the undesired direction (e.g., more depression, less well-being). There was a change in the desired direction for all eight variables for the MBSR group and for all except mindfulness and pain for the CBSR group.

Using Cohen’s guidelines for interpreting effect sizes,³⁰ the MBSR group showed very large changes in depression and energy level, medium-to-large changes in perceived stress, neuroticism, well-being, and pain, a medium change in mindfulness, and a small-to-medium change in binge eating. For the CBSR group, there was a very large change in depression, a medium-to-large change in perceived stress, small-to-medium changes in neuroticism, well-being, and energy, and a very small change in binge eating. In addition, there was a moderate *decrease* in mindfulness and a small *increase* in pain.

On all measures, the MBSR group had larger effects in the desired direction. The difference in effects size between MBSR and CBSR were large for mindfulness (1.045), en-

TABLE 1. DESCRIPTIVE STATISTICS FOR THE MBSR AND CBT COURSES

Statistics	MBSR 1	MBSR 2	CBSR 1	CBSR 2
Age				
Mean	46.33	48.55	39.44	40.20
Standard deviation	13.75	13.19	14.64	12.85
Gender				
Female	20	10	6	4
Male	5	1	3	1
Income				
Less than \$25,000	6	1	1	1
\$25,000–\$49,999	3	5	2	3
\$50,000–\$74,999	7	2	1	1
\$75,000–\$99,999	0	1	1	0
\$100,000 or more	7	2	4	0
Missing	2	0	0	0
Education				
Pre–high school	1	0	1	0
High school graduate	0	0	1	0
Some college	6	2	0	0
College graduate	3	2	3	1
Graduate/professional school	15	7	4	4
Missing	0	0	0	0

MBSR, mindfulness-based stress reduction; CBSR, cognitive-behavioral stress reduction.

TABLE 2. PRE AND POST SCORES FOR THE MINDFULNESS-BASED STRESS REDUCTION GROUP PARTICIPANTS

Variable	Pre	Post	t ^a	p
Primary outcomes				
Mindfulness	3.68 (0.92)	4.12 (0.86)	-3.294	0.002
Perceived stress	1.97 (0.69)	1.48 (0.64)	4.990	0.000
Psychological health				
Depression	12.18 (7.56)	3.78 (4.20)	6.207	0.000
Neuroticism	3.19 (0.73)	2.75 (0.75)	5.074	0.000
Well-being	4.42 (0.75)	4.82 (0.55)	-4.214	0.000
General health				
Binge eating	1.80 (0.59)	1.58 (0.43)	3.982	0.000
Energy	49.31 (20.93)	73.89 (15.24)	-8.202	0.000
Pain	28.19 (27.18)	14.24 (12.94)	4.109	0.000

Note. The sum of all items is reported for the depression measure (as is customary for the Beck Depression Inventory), the visual analog score (0–100 mm) is reported for the pain and energy measures, and the item means are presented for the rest of the measures.

^a*df* = 35.

ergy (1.016), and pain (0.871), moderate for neuroticism (0.333), binge eating (0.326), and well-being (0.250), and small for depression (0.169) and perceived stress (0.084). Across all variables, the mean effect size for the MBSR group was more than twice as large as that for CBSR (0.819 vs. 0.384, respectively).

Pre–post score changes were compared across groups by using a general linear model with repeated measures. Table 4 shows the group × variable interactions for each variable. There were significantly greater increases in mindfulness and energy and significantly greater decreases in pain in the MBSR group, as compared with the CBSR group. There was also a trend toward a greater reduction in binge eating in the MBSR group. Multivariate analyses were also conducted to compare groups on changes across all variables. The group × variable interaction was significant, demonstrating

that there was a greater change in the MBSR participants, as compared with the CBSR participants ($F(8,41) = 3.139$; $p = 0.007$).

DISCUSSION

The aim of this pilot study was to compare the effects of MBSR and CBSR interventions on a range of health-related outcomes. Overall, we found that participants in both the MBSR and CBSR interventions generally improved. As predicted, reductions in perceived stress and depression occurred for participants in both interventions. Also as predicted, the MBSR group showed an increase in mindfulness. MBSR was associated with improvements on all eight measures, with all differences being significant. CBSR was as-

TABLE 3. PRE AND POST SCORES FOR THE COGNITIVE-BASED STRESS REDUCTION GROUP PARTICIPANTS

Variable	Pre	Post	t ^a	p
Primary outcomes				
Mindfulness	4.30 (0.86)	3.75 (1.12)	1.544	0.146
Perceived stress	1.82 (0.87)	1.33 (0.61)	2.875	0.013
Psychological health				
Depression	10.92 (6.93)	3.99 (4.41)	4.900	0.000
Neuroticism	2.95 (0.78)	2.74 (0.82)	1.704	0.112
Well-being	4.54 (0.77)	4.81 (0.74)	-2.408	0.032
General health				
Binge eating	1.49 (0.48)	1.44 (0.47)	1.088	0.296
Energy	56.07 (22.55)	62.14 (20.26)	-0.930	0.369
Pain	15.71 (23.44)	20.36 (19.85)	-0.975	0.347

Note. The sum of all items is reported for the depression measure (as is customary for the Beck Depression Inventory), the visual analog score (0–100 mm) is reported for the pain and energy measures, and the item means are presented for the rest of the measures.

^a*df* = 13.

TABLE 4. COMPARISON OF EFFECT SIZES AND CHANGES FOR THE MBSR AND CBSR PARTICIPANTS

	Cohen's d		Group × variable ^a	
	MBSR	CBSR	F ^b	p
Primary outcomes				
Mindfulness	0.494	-0.551	10.407	0.002
Perceived stress	0.736	0.652	0.000	0.983
Psychological health				
Neuroticism	0.595	0.262	2.257	0.140
Depression	1.365	1.196	0.409	0.526
Well-being	0.608	0.358	0.567	0.455
General health				
Binge eating	0.426	0.100	3.482	0.068
Energy	1.346	0.330	8.691	0.005
Pain	0.658	-0.213	8.969	0.004

MBSR, mindfulness-based stress reduction; CBSR, cognitive-based stress reduction.

^aGeneral linear model results for the univariate group and variables interactions.

^b*df* = 1 for interaction, 1 for main effect, 48 for error.

sociated with improvements on six of eight measures, with significant improvements in perceived stress, depression, and well-being.

We found differences in the effects for the MBSR and CBSR groups. When averaged across all eight outcomes, the effect size for improvements was more than twice as large for the MBSR, as compared with the CBSR group. The differences in effects were largest for mindfulness, pain, and energy, and moderate for binge eating, neuroticism, and well-being. Multivariate tests showed that the MBSR group had significantly greater improvement across all outcomes. Univariate tests showed that the significant differences in mindfulness, pain, and energy and a trend for binge eating.

Why did we find these differences in effects between the MBSR and CBSR groups? We cannot rule out that a self-selection bias may have played a role because the subjects were not randomly assigned to the groups. However, we used the same recruitment methods for both groups and they were not significantly different on any of the demographic or health variables, except for mindfulness. The greater improvements in the MBSR group might also be related to differences in instructor training and experience, cost of the courses, and the 6-hour MBSR retreat. However, it is doubtful that these factors completely accounted for the large differences found on some outcomes. In addition, the effects of MBSR and CBSR were very similar on perceived stress, a primary target variable of these stress-management interventions. Moreover, the very strong effect of CBSR on depression suggests it was successful in targeting a measure that has been a strong focus of CBT interventions.⁷

Despite the limitations of this study, the large and significant differences in effects on mindfulness, pain, and energy suggest that the contrasting approaches of these mind-body interventions may have played a role. While it

is not surprising that the MBSR intervention was associated with an increase in mindfulness, it is intriguing that the CBSR intervention was associated with a decrease (moderate in size but not significant) in mindfulness. The accepting and observant attitude emphasized in MBSR may have facilitated the growth of mindful awareness, while the focus on judging and changing thoughts and feelings in CBSR may have actually helped to shut it down.

Why might MBSR have a greater effect on pain and energy? There is increasing evidence that the acceptance of pain may have more beneficial effects than trying to control pain.³¹ It is possible that the differences we found may be related to a more accepting attitude toward one's inner experience. If this acceptance increased mindful attention to, and awareness of, moment-to-moment experience, then MBSR subjects may have been better able to monitor and respond to internal cues that are important in regulating behavior related to pain and energy (e.g., when to rest and when to exert themselves). Enhanced self-monitoring and self-regulation may also help to explain the reductions we found in binge eating in the MBSR group.²⁰ In contrast, the increased efforts of CBSR participants to change and control thoughts and feelings may reduce the awareness of cues perceived as "negative" and may have made it more difficult to regulate behavior that may influence pain, energy, and eating behavior.

The primary implication of this initial study is that further research should be conducted examining the differential effects of cognitive behavioral and mindfulness-based mind-body interventions. Because these interventions appeared to differentially affect mindfulness, randomized, controlled trials should examine the extent to which accepting versus judgmental approaches to one's inner experiences influence the development of mindfulness. Most important,

these trials should examine the effects of these approaches on outcomes that may require greater attention to, and awareness of, internal cues, such as pain, energy/fatigue, eating behavior, and exercise. If mindfulness-based interventions and a more accepting, observant attitude toward internal cues are shown to be more effective for people with physical and somatic concerns, then mindfulness-based approaches may be a mind–body treatment of choice for them.

CONCLUSIONS

While MBSR and CBSR may both be effective in reducing perceived stress and depression, MBSR may be more effective in increasing mindfulness and energy, reducing pain, and possibly in reducing binge eating. The increased effectiveness of MBSR with regard to these outcomes may be related to the cultivation of a more accepting, observant attitude toward the whole range of one's inner experience. Future research should include randomized, controlled trials comparing cognitive-behavioral and mindfulness-based interventions and determine why they may have different effects on somatic outcomes such as pain, energy, and binge eating.

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