

# Effects of Low-Dose Mindfulness-Based Stress Reduction (MBSR-ld) on Working Adults

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Mindfulness-based stress reduction (MBSR) has produced behavioral, psychological, and physiological benefits, but these programs typically require a substantial time commitment from the participants. This study assessed the effects of a shortened (low-dose [ld]) work-site MBSR intervention (MBSR-ld) on indicators of stress in healthy working adults to determine if results similar to those obtained in traditional MBSR could be demonstrated. Participants were randomized into MBSR-ld and wait-list control groups. Self-reported perceived stress, sleep quality, and mindfulness were measured at the beginning and end of the 6-week intervention. Salivary cortisol was assessed weekly. Significant reductions in perceived stress ( $p = .0025$ ) and increases in mindfulness ( $p = .0149$ ) were obtained for only the MBSR-ld group ( $n = 22$ ). Scores on the global measure of sleep improved for the MBSR-ld group ( $p = .0018$ ) as well as for the control group ( $p = .0072$ ;  $n = 20$ ). Implications and future research are discussed.

**Keywords:** *work-site stress reduction; mindfulness meditation; working adults*

Stress-related illness generates large health care expenditures for both employer and employee. Employees who experience chronic stress can have impaired job performance and increased risk of stress-related illness such as hypertension, risk factors of coronary heart disease, depression (Tennant, 2001), and sleep disorders (A. Williams, Franche, Ibrahim, Mustard, & Layton, 2006). These rising health care costs are powerful incentives for companies to offer work-site wellness programming that includes stress management classes. Such classes have become an increasingly popular vehicle for delivering the tools to help people manage stress and are a cost-effective way to reduce the risk of stress-related chronic illness (van der Klink, Blonk, Schene, & van Dijk, 2001). Sustained stress, even at low levels, can increase the risk of disease, affect

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immune response (Glaser, Sheridan, Malarkey, MacCallum, & Kiecolt-Glaser, 2000), and provoke sleep disturbances (A. Williams et al., 2006).

There is good evidence that work-site programs that focus on managing stress and anxiety and on developing coping skills can significantly reduce illness and health care utilization (Rahe et al., 2002). One program that has been utilized in this manner is mindfulness-based stress reduction (MBSR), developed in 1979 by Jon Kabat-Zinn at the University of Massachusetts Medical Center's outpatient stress reduction clinic. This program has been used as a model for other medical centers and settings as a stress reduction intervention (Kabat-Zinn, 2003). Mindfulness meditation teaches nonjudgmental awareness of sensation, emotion, cognition, and perception and provides a method to observe the mind's filtering of both internal and external experience. Mindfulness encourages a state of mind in which one distances from one's own mental noise. It allows for a new awareness of mind that permits focused attention on releasing stressful constructions and a more relaxed moment-to-moment awareness and movement. MBSR is a participatory educational approach, exposing the power of internal resources in framing what a person experiences as stressful. Lifestyle change in MBSR refers to a change in one's interior disposition toward awareness. Awareness of one's affective response to external events is presented as the key to changing one's internal experience of stress. Events may be perceived positively or negatively and may be within or beyond our control, but to become aware of our affective responses to internal and external events is the core activity of MBSR. The only goal in MBSR is to habitually participate in meditation, without evaluating one's meditation performance.

MBSR currently has substantial research-based evidence for its efficacy in a variety of medical, social, educational, intercultural, and work-site settings (Kabat-Zinn, 2003) and has been found useful for a variety of symptoms and illnesses including anxiety, binge eating disorders, depression, cancer, coronary artery disease, chronic pain, and psychiatric disorders. Both controlled and uncontrolled studies of MBSR (Grossman, Niemann, Schmidt, & Walach, 2004) show effect sizes of approximately .5 ( $p < .0001$ ) with a homogeneity of distribution. Improvements have been noted in standardized mental health measures including quality of life scales, depression, anxiety, coping style, social functioning (Reibel, Greeson, Brainard, & Rosenzweig, 2001), and other affective dimensions of disability, all of which affect workers' ability to function in the workplace. Although physical and biologic measures were less frequently assessed in these studies, improvements were noted in pain control, functional quality of life, psoriatic skin disease (Grossman et al., 2004), and in a previous MBSR work-site study (Davidson et al., 2003), immune function.

The MBSR program typically requires participants to commit to a 2.5- to 3-hour instructor-led group session each week and 45 to 60 minutes of mindfulness practice each day for 8 weeks. Much of the research conducted on the benefits of MBSR has utilized participants who are highly motivated medical patients willing to make the time commitment necessary to satisfy these program requirements. With these participants, program adherence is approximately 85%, whereas in another university community MBSR program, the adherence rate was only 70% to 75% (K. A. Williams, Kolar, Reger, & Pearson, 2001).

MBSR programs can provide a low-cost, high-yield benefit for workers dealing with chronic stress, but the MBSR program has to be in a sustainable, realistic form for the population being served. There are two aspects of the typical MBSR program that may be barriers to effective implementation in a work-site setting. First, participants must make a considerable time commitment on a weekly and a daily basis. One study using MBSR (Chang et al., 2004) indicated that high attrition rates were caused by the required time commitment. Second, yoga is often utilized in MBSR, but limited

work-site space may make the inclusion of yoga difficult. Yoga, a method for managing stress that has a long history as a health care treatment in non-Western cultures, has grown in popularity as a complementary treatment for several physical and mental diseases (Raub, 2002). There is evidence that the regular practice of yoga is also effective as a low-cost stress management technique (Baldwin, 1999), and yoga in the workplace has been shown to be a practical strategy for relieving tension and job stress (Gura, 2002). However, inconvenience, such as the need to change clothes and to find appropriate space, makes it difficult to practice yoga regularly at the work site, thus diminishing its usefulness as a stress management tool in the workplace.

We have addressed these barriers through the development of an abbreviated MBSR program, MBSR-ld (low dose), that could realistically be done at work by employees in their professional attire, with the least amount of time spent away from the home and family. MBSR-ld was specifically designed as a pragmatic adaptation of MBSR to the work site by the first author, who participated in a 7-day MBSR professional training under the direction of Jon Kabat-Zinn, PhD, and Saki Santorelli, EdD, and has been using MBSR in her personal meditation practice and university classes since 1995. To minimize the time commitment, the duration of weekly meetings was reduced from 2.5 to 3 hours to 1 hour, the daily 45 to 60 minutes of meditation were reduced to 20 minutes of meditation/yoga, and the full-day retreat within traditional MBSR was omitted. MBSR-ld participants attended abbreviated weekly meetings during their lunch hour, with an abbreviated daily meditation given to them via a two-CD set. The CD and premeditative workspace yoga stretches were included to decrease the time committed and to minimize inconvenience.

In 2002 researchers produced an operational definition of mindfulness for research investigations concerning the mediating role and mechanism of the action of mindfulness (Bishop, 2002). The two critical components were determined to be (1) self-regulation of attention and (2) the adoption of an orientation toward one's experiences in the present moment. MBSR-ld was developed to retain the construct of mindfulness, as originally conceived and taught by Kabat-Zinn, while adapting it for working adults. MBSR-ld is comparable to traditional MBSR programs concerning the operational definition, differing only in the amount of time both per day and week committed to the intervention.

Therefore, the purpose of this study was to determine whether the MBSR-ld program would produce a statistically significant decrease in symptoms of stress and yield adherence rates that mimicked those of traditional MBSR interventions (85%). Specifically, we hypothesized that participants in the MBSR-ld group would demonstrate significant reductions in perceived stress and improvements in sleep. We also hypothesized that there would be reductions in salivary cortisol, a biological marker of stress, given the suggested link between reductions in perceived stress and cortisol secretory activity (Kamei et al., 2000). Mindfulness was measured using an established self-report instrument (Brown & Ryan, 2003); tracking the actualization of moment-to-moment awareness was predicted to increase for the intervention group and not for the control group.

## METHOD

### Participants

Full-time faculty and staff employed at a large midwestern university were recruited through e-mail announcements, health fair presentations, and faculty and staff newsletters advertising a stress reduction research study. For inclusion, participants had to be between the ages of 18 and 60, have a BMI  $\leq$  30, exercise less than 30 minutes on most

days of the week as determined by responses to the Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985), and consume no more than two alcoholic beverages per day and no more than six beverages with caffeine per day. They also could not be pregnant or nursing, currently engaged in regular yoga practice or a weekly yoga class, and have a recent or chronic illness that required medication, as these potentially could confound quality of sleep.

Interested faculty and staff attended one of three possible familiarization meetings. At these meetings, the risks and benefits of participating in the study were outlined and questions about the study were addressed. More than 60 full-time faculty and staff volunteered to participate in the study without any financial incentive. Forty-eight volunteers met the inclusion/exclusion requirements and were enrolled in the study. A BMI of more than 30 was the most frequent exclusion criteria, followed by chronic illnesses requiring multiple medications. Additional volunteers were excluded because of exceeding the minimal exercise criteria.

### **Procedure**

Upon completion of informed consent, participants were randomized to the MBSR-Ild intervention ( $n = 24$ ) or a wait-list control group ( $n = 24$ ). Participants in the intervention group were enrolled in the 6-week MBSR-Ild program. The wait-list control group was offered MBSR-Ild following the completion of the intervention group. Both the intervention and wait-list control participants completed the self-report questionnaires before beginning the intervention (pretest) and after completion of the intervention (posttest). Salivary cortisol samples were given by all participants according to the study protocol (see the Measures section). The only procedural difference between groups was the collection of the questionnaires and salivary cortisol samples. Two graduate research assistants collected questionnaires and cortisol from the wait-list control participants at their campus offices, whereas the intervention participants brought their salivary cortisol samples to the MBSR-Ild meetings.

### **Intervention**

The MBSR-Ild intervention consisted of group instruction for 60 minutes, once per week, at noon in a centrally located campus classroom. Similar to the Kabat-Zinn protocol, MBSR-Ild incorporated breathing, relaxation, body scans, and gentle yoga movement as facilitation toward a meditative state. The primary aim of all techniques utilized in the intervention was to enhance the participants' ability to pay attention to their moment-to-moment, internal and external experience. This program was geared toward the local stresses commonly experienced by healthy working adults. Work environment stresses were discussed in the formal education segment of the weekly meetings, alongside presentations of the physiology of stress and its symptoms, causes, and so forth. The premeditation yoga stretching was important for individuals who spend the majority of their working day seated, bringing the focus to the breath and body and enabling meditative awareness. The design utilized physical movement to facilitate mental quieting, yet the yoga stretches in MBSR-Ild could all be done seated or standing within the physical confines of a typical workspace. These stretches were appropriate for a work environment and did not require the participant to remove shoes, change clothes, or use a yoga mat. The workspace yoga postures were introduced with the intention of facilitating formal mindfulness meditation.

MBSR-ld participants were instructed to wear loose-fitting professional attire that allowed movement. Handouts were used to illustrate concepts, and homework reflections were listed in the adherence workbook. Each meeting began with verbal instructions that served as the prompt for contemplation during the next hour. For example, participants were asked to think back over their past week and identify what elicited a stress response, and each week they were asked to focus on a particular dynamic such as “When were other times in your life that you felt like you were going from one unbalanced state to another, shifting back and forth, and never feeling ‘sure-footed’?” There were no right or wrong responses to any prompt. Each participant considered his or her personal response to the prompt when the prompt was later called up as the focus of that week’s meditation. Each participant’s response to the prompt was personal and silent, but some participants chose to share their responses to the prompt at the beginning of the hour. There was no pressure, nor encouragement, to volunteer thoughts.

It was emphasized to all participants that they should bring an attitude of respect and mutual discovery to the process and a nonjudgmental attitude to the 6-week program. It was necessary for each individual to engage in the intervention without evaluation of progress toward his or her stress reduction goals because mindfulness is defined as a nonjudgmental, moment-to-moment awareness. Until the study was completed, the participants were asked to reserve judgment and focus on becoming aware of momentary experience. Only after completion of the study were they asked to evaluate if their increased awareness of their affective responses facilitated a reduction in stress reactivity.

Participants were instructed to complete individual sessions of daily meditation for 20 minutes during the remaining work days for the 6-week intervention (i.e., 23 total individual sessions). At the first group meeting, each MBSR-ld participant was given an adherence workbook to track his or her daily meditations, saliva collection, and a record of any confidential reflections or thoughts. Participants also received two CDs each with six different 20-minute daily meditations. Each participant agreed to listen to the daily mindfulness meditations on the CD four times per week for the duration of the intervention. This meant that each participant was expected to engage in mindfulness meditation each workday for the 6 weeks of the intervention and to record adherence to the protocol daily. There was a written explanation of each track provided so that each participant could choose which track best fit his or her circumstances for the particular day.

Each 20-minute track was an abbreviated version of the weekly 60-minute experience in mindfulness meditation and corresponded to the theme of the weekly meeting, reinforcing techniques used in class. The audio program built on the hourly instruction and included options for daily meditations such as guidance in movement for relaxation and focus, breathing exercises, awareness training, balance in life, awareness of body through centering on body sensations, feeling secure, clarity and release, and commitment to daily practice.

## Measures

At pretest, all participants completed a demographic questionnaire that included age, gender, height, weight, race, job classification, and marital status. Within 5 days after the study was completed, MBSR-ld participants completed a program evaluation that included items related to specific components of the MBSR-ld. At the pretest and posttest, investigators administered the following self-report questionnaires:

*Perceived Stress Scale.* Participants rated their responses to 10 statements about their feelings and thoughts during the past month (pretest) and 6 weeks (posttest) on a 5-point

Likert-type scale ranging from *never* to *very often*. The Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983) measures the degree to which situations in life are appraised as stressful. Items are designed to evaluate how overloaded, unpredictable, and uncontrollable one finds one's life. It also queries current levels of experienced stress. Cohen et al. (1983) reported internal consistency scores of .84, .85, and .86. In our sample, Cronbach's  $\alpha$  was .87.

*Pittsburgh Sleep Quality Index.* Participants responded to 24 items of the Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) that measure sleep quality and disturbances during a 1-month period (pretest) and the previous 6 weeks (posttest). This is a self-rated instrument that assesses sleep quality and sleep dysfunction. It has good diagnostic sensitivity and specificity (a score of 6 or above yields a diagnostic sensitivity of 89.6% and a specificity of 86.5%) in distinguishing good and poor sleep. The scale yields a total score as well as seven subscale scores: Participant Sleep Quality, Sleep Latency, Sleep Duration, Habitual Sleep Efficiency, Sleep Disturbances, Use of Sleep Medications, and Daytime Dysfunction.

*Mindful Attention Awareness Scale (MAAS).* Participants rated 15 statements from the MAAS (Brown & Ryan, 2003) on a 6-point Likert scale to determine the frequency of mindful states over time, specifically the presence or absence of attention to and awareness of what is occurring in the present. The items in the scale are distributed across cognitive, emotional, physical, interpersonal, and general domains, and higher scores reflect more mindfulness. Brown and Ryan (2003) reported good test-retest reliability over 2 weeks ( $r = .81$ ) and convergent, discriminate, and criterion validity. In our sample, Cronbach's  $\alpha$  was .91.

*Assessment of Salivary Cortisol.* Saliva samples were collected using a Salivette (Sarstedt, Inc., Newton, NC). Salivary cortisol measurement allows frequent self-sampling, approximates mean 24-hour cortisol secretion, and measures free biologically active cortisol because in its passage from serum to saliva it is removed from its binding protein. It is highly correlated with serum cortisol levels. Baseline levels of salivary cortisol were established from 2 consecutive days of sampling conducted 20 minutes after waking but prior to brushing teeth (approximately 7:00 a.m.), at 1:00 p.m., and at 10:00 p.m. Salivary cortisol was sampled again 20 minutes after waking but prior to brushing teeth (approximately 7:00 a.m.), at 1:00 p.m., and at 10:00 p.m. once per week on the same day of the week during each week of the intervention, and again for 2 days at 1 week after completion of the intervention. After collection, the procedure was to remove the suspended inner tube and pour the saliva into 12  $\times$  75 polypropylene storage tubes, which were frozen until assayed. Cortisol determinations were made using the Cortisol Coat-A-Count RIA (Diagnostic Products Corporation, Los Angeles, CA). Intra-assay variation is 4.3%, and interassay variation is 5.2%. Sensitivity is adequate for this population at .025  $\mu\text{g/dL}$ .

## Analysis

In anticipation that the biometric change would be the most sensitive change to detect, power calculations were conducted to determine an adequate sample size to detect significant changes in salivary cortisol. Twenty participants were needed in each group (total sample size = 40) for adequate power (i.e., .80) to determine a significant difference. A sample size of 48 participants was set to control for a potential dropout of

Table 1. Demographics<sup>a</sup>

Variables	MBSR-ld ( <i>n</i> = 22)	Control ( <i>n</i> = 23)
Age ( <i>M</i> ± <i>SE</i> )	43.41 ± 2.17	46.50 ± 1.89
BMI (kg · m <sup>-2</sup> )	22.91 ± 0.49	23.58 ± 0.64
Gender (% female)	77	73
Ethnicity (%)		
Caucasian	72	86
African American	9	0
Latino	5	0
Asian	0	9
Other	14	5
Marital status (%)		
Single	14	14
Married/partnered	73	77
Divorced	13	9

a. There were no significant differences between groups.

15% to 20%. Summary statistics for demographic variables were computed. Changes in the response variables from their baseline values (pre/post) were examined using paired *t* tests. All *p* values under .05 were statistically significant.

## RESULTS

Forty-eight participants were randomized to the intervention and control group. Two participants dropped out, one from the control group who was unwilling to comply with the randomization and one from the intervention group because of a family emergency. One MBSR-ld participant did not complete at least 80% of the intervention and was not included in the analysis. Adherence to the study protocol was emphasized and recorded each day during the study. The analyses were conducted on 22 participants in the intervention group and 20 participants in the control group. Three control participants did not have complete data and were not included in the analysis. Adherence to the MBSR-ld protocol was 85%, with no differences in outcome measures detected based on gender, age, or job classification. Most of the participants were classified as research assistants (31%), midlevel management (29%), or faculty (13%). Please see Table 1 for demographic information.

### Mindfulness, Perceived Stress, and Quality of Sleep

There was a significant increase in MAAS scores for the intervention ( $p = .0149$ ,  $d = .56$ ) but not the control group. Scores on the Perceived Stress Scale decreased significantly for the MBSR-ld ( $p = .0025$ ,  $d = .73$ ) but not the control group. The global measure of sleep from the Pittsburgh Sleep Quality Index improved significantly for both the MBSR-ld group ( $p = .0018$ ,  $d = .76$ ) and the control group ( $p = .0072$ ,  $d = .68$ ). However, three of the seven components of sleep quality showed significant improvement for the intervention group. Reports on subjective sleep quality ( $p = .0162$ ,  $d = .54$ ), sleep latency ( $p = .0355$ ,  $d = .48$ ), sleep disturbances ( $p = .0157$ ,  $d = .56$ ), and daytime dysfunction ( $p = .0162$ ,  $d = .56$ ) were significantly better at the end of the intervention compared to the pretest (see Table 2).

Table 2. Mindfulness, Perceived Stress, and Sleep Scores ( $M \pm SE$ )

Measure	MBSR-1d ( $n = 22$ )				Control ( $n = 20$ )			
	Pre	Post	Diff	$p$ value <sup>a</sup>	Pre	Post	Diff	$p$ value <sup>a</sup>
MAAS	55.14 + 2.90	60.50 + 2.65	-5.36 + 2.02	.0149	63.15 + 3.08	63.70 + 2.57	-0.55 + 1.57	.7294
Perceived Stress Scale	28.09 + 1.19	25.00 + 0.96	3.09 + 0.90	.0025	26.20 + 1.30	25.55 + 1.46	0.65 + 0.86	.4586
PSQI component scores								
Global PSQI	6.73 + 0.69	5.00 + 0.46	1.73 + 0.48	.0018	6.68 + 0.67	5.50 + 0.68	1.18 + 0.39	.0072
Subjective Sleep Quality	1.23 + 0.13	0.91 + 0.15	0.41 + 0.16	.0162	1.22 + 0.14	0.89 + 0.15	0.35 + 0.18	.0692
Sleep Latency	1.09 + 0.20	0.68 + 0.19	0.41 + 0.18	.0355	0.75 + 0.20	0.65 + 0.18	0.10 + 0.14	.4936
Sleep Duration	0.91 + 0.11	0.82 + 0.13	0.09 + 0.09	.3287	1.00 + 0.18	1.00 + 0.19	0.00 + 0.10	1.000
Habitual Sleep Efficiency	0.14 + 0.07	0.18 + 0.11	-0.05 + 0.08	.5758	0.35 + 0.15	0.25 + 0.12	0.10 + 0.07	.1625
Sleep Disturbances	1.41 + 0.11	1.09 + 0.11	0.32 + 0.12	.0157	1.65 + 0.13	1.35 + 0.11	0.30 + 0.15	.0553
Use of Sleeping Medications	0.50 + 0.17	0.27 + 0.10	0.23 + 0.17	.2037	0.50 + 0.22	0.55 + 0.25	-0.05 + 0.18	.7894
Daytime Dysfunction	1.45 + 0.17	1.05 + 0.15	0.41 + 0.16	.0162	1.20 + 0.19	0.85 + 0.15	0.35 + 0.18	.0692

NOTE: MAAS = Mindful Attention Awareness Scale; PSQI = Pittsburgh Sleep Quality Index.

a. Based on paired  $t$  tests for the null hypothesis that there is no difference.



Table 3. MBSR-ld Participant Ratings of Program Components ( $n = 18$ )

Program Component	<i>M</i>	<i>SD</i>
Weekly session	9.1	0.93
Body scan	8.6	1.55
Yoga stretches	8.7	1.34
Breathing awareness	9.0	1.14
Meditation	8.7	1.44
Handouts	7.2	1.60
Teacher personality	8.8	1.23
20-minute CD	9.3	0.83
Reflection questions	5.5	2.06

NOTE: Likert-type scale: 1 = *useless*; 10 = *extremely useful*.

### Cortisol Levels

Despite randomization, baseline salivary cortisol was higher in the control compared to the MBSR-ld group. Regardless, there were no changes in average daily salivary cortisol levels over time for participants in both groups and no differences from the pretest to the posttest.

### MBSR-ld Program Evaluation

Participants in the MBSR-ld ( $n = 18$ ) also rated components of the program based on individual usefulness using a 10-point Likert-type scale, with 10 indicating most useful (see Table 3). The two most highly rated components of the program were related to the time commitment of the intervention: the 1-hour weekly meetings and the 20-minute daily meditations.

## DISCUSSION

The purpose of this study was to assess the feasibility and effectiveness of MBSR-ld as a stress reduction intervention in a group of healthy working adults when offered at the work site. A comprehensive review and meta-analysis of studies conducted on MBSR and health benefits (Grossman et al., 2004) showed that MBSR may help a broad range of individuals cope with clinical and nonclinical problems, from individuals struggling with chronic illness to healthy individuals dealing with the stresses of daily life. Our intent was to adapt MBSR to a “dose” that was feasible but produced similar adherence rates and outcome measures as traditional MBSR interventions. Both objectives were obtained in this study. Effect sizes equal to and greater than traditional MBSR studies were obtained. The connections between stress and various health outcomes are being investigated as the cost of health care continues to rise. A low-cost, on-site stress reduction program that shifts an individual’s perspective on stress by increasing a mindful approach to life could be beneficial for both employee and employer. Work-site location and yoga adapted for the work site were components of this intervention that were considered essential for the positive outcomes and good adherence.

### **Work-Site Location**

MBSR-ld was structured so that employees would be drawn to participate in the program, as the lunch-time weekly meeting did not infringe on work or family time. MBSR-ld also accommodated the time and space confines of most working adults. High ratings were given to the value and location of the weekly meetings, as employees participated in a program at work that addressed awareness of perceived stress without distinction between work and home stresses. The focus was on becoming aware of moment-to-moment, internal and external experiences, especially those that produced stress reactivity.

The MBSR-ld component that received the highest rating by participants was the 20-minute mindfulness meditation provided to them via the two-CD set, as participants were able to practice the MBSR-ld meditation at work, during a 20-minute break.

### **Yogic Movement Appropriate for the Work Site**

The yoga movement designed with workspace limitation in mind allowed movement for individuals within their workspaces, introducing participants to possible movements within those parameters. Most participants were not aware of the possible range of yoga movement suggested in MBSR-ld.

The MBSR-ld intervention (both the weekly group meeting and the daily meditations) included substantial yoga stretches and breathing exercises to facilitate mindfulness in a population that spends the majority of their working hours seated at a desk. Yoga has gained acceptance and popularity in American culture as a stress reduction technique and a complementary and alternative medical (CAM) approach to wellness, such that it is 1 of the 10 most common CAM therapies used today (Barnes, Powell-Griner, McFann, & Nahin, 2004). Yoga movement is no longer considered “fringe” activity but is commonly identified in popular culture as a stress reduction technique. Thus, yogic movement was emphasized, not de-emphasized, in the MBSR-ld protocol. There is also research evidence that a physiological change occurs with the practice of yoga that enhances the ability to deal with stress (Schell, Allolio, & Schonecke, 1994). However, yoga classes can be inconvenient and time consuming, which can make attendance difficult, thereby diminishing their usefulness as a stress management method. MBSR-ld offered a procedure for practicing yoga at the work site that removed such barriers to regular yoga practice.

### **MBSR-ld Outcome Measures**

*Perceived Stress.* Significant reductions in perceived stress obtained by the MBSR-ld group were of the same magnitude as traditional MBSR interventions (Grossman et al., 2004). This illustrates the pragmatic value of a lower dosed program for populations with time and space limitations.

*Quality of Sleep.* The National Institutes of Health (NIH) State-of-the-Science Conference Statement on Manifestations and Management of Chronic Insomnia in Adults in 2005 emphasized that insomnia seems to be associated with high health care utilization, with the direct and indirect costs of chronic insomnia costing billions annually. MBSR-ld significantly improved participants’ subsets of subjective sleep quality—sleep disturbances, sleep latency, and daytime dysfunction—as compared to controls. Clearly, a restful night’s sleep is an important aspect of daytime functionality. The improvements in restorative sleep may be the most important results achieved in this

study. When insomniac patients are asked about their sleep patterns, they consider daytime improvements in fatigue, irritability, and performance to be the benchmarks of treatment response (Carey, Moul, Pilkonis, Germain, & Buysse, 2005). The other two subsets that significantly changed were reductions in both sleep latency and sleep disturbances.

*Mindfulness.* Much of the MBSR literature uses outcome measures of psychological health such as the Profile of Mood States, but few studies have utilized the Brown and Ryan scale as a quantitative measure of actually changing one's ability to attend to the present moment. This study examined whether an MBSR intervention actually affected an individual's ability to acquire "present-centered attention awareness." The answer was affirmative and was correlated with reductions in perceived stress and improvements in quality of sleep. Thus, the Brown and Ryan scale may be an appropriate measure of actual changes in mindfulness as operationally defined (Bishop, 2002).

*Salivary Cortisol.* Because MBSR-Id focused heavily on yoga stretches to facilitate the meditation practice in both the weekly and daily practice, and hatha yoga practice had been associated with a decrease in salivary cortisol for college students (West, Otte, Geher, Johnson, & Mohr, 2004), a hypothesis of this research was that there would be a decrease in daily salivary cortisol averages for the intervention group during the 6 weeks of the intervention. Although there had been preexisting conflicting data elsewhere concerning the effects of yoga on cortisol levels (Kamei et al., 2000; Schell et al., 1994), the hope was to establish a correlation between decreases in self-reported stress and physiological decreases in salivary cortisol from pre- to posttest. Posttest cortisol levels were not significantly reduced for the MBSR-Id participants whereas the perceived stress scores were significantly reduced. There was no significant correlation between self-reported baseline stress and salivary cortisol. This finding was consistent with a recent study exploring the correlation between psychological measures and biological measures in breast cancer patients in which no correlation was found (Carlson, Campbell, Garland, & Grossman, 2007).

This may highlight the complex nature of using salivary cortisol as a solitary marker of physiological manifestation of stress. Salivary cortisol levels can be affected by diet and physical activity, which were not controlled in this study. Directions were given to the participants concerning dietary intake, the necessity of refraining from brushing teeth, and so forth within 20 minutes of obtaining the salivary cortisol sample, but in a community study, this was difficult to control, and several intervention participants would walk from their offices to the weekly meeting. Salivary cortisol is an accessible biomarker of stress but may be confounded by too many other variables to be used as a sole physiological measure of stress to supply meaningful research data.

### **Limitations and Future Directions**

In this study, self-reported measures of perceived stress were measured only pre- and postintervention while salivary cortisol levels were assessed weekly. It would have strengthened the study to have participants fill out the perceived stress test weekly to establish a correlation between perceived stress and salivary cortisol levels. Various other physiological variables, such as resting blood pressure, could also have been measured weekly to establish correlations between perceived stress and physiological measures of stress. The question of the correlation between self-report instruments and physiological evidence was not clearly established. Future research using MBSR and yoga needs to examine the correlation between self-report measures and physiological

markers of stress. Participants clearly report improvements in sleep quality and perceptions of stress, but further research is needed to identify the physiological evidence that stress is indeed reduced due to the intervention. Also, there was no follow-up assessment included, so it is uncertain if positive results were sustained over time.

Conducting a relatively small study on the campus of a large university may have affected the generalizability of the results, as participants were faculty and staff volunteers, met a substantial list of exclusion criteria, and thus were a select group of motivated participants.

One feature of the MBSR-ld intervention that we did not measure was the impact of a shared sense of lifestyle change with colleagues at work. None of the research participants had offices in the building where the intervention was conducted. An MBSR-ld work-site intervention in which employees could attend the weekly meeting within the building in which they work, with coworkers, might affect the results obtained. Most participants in this study did not know each other or work together. A recent study (Oginska-Bulik, 2005) has confirmed the critical role of personal and social resources and perceived social support in reducing job stress and preventing negative health outcomes for workers of uniformed professions. Additionally, positive psychosocial work features, such as social support, have been associated with fewer sleep disruptions (A. Williams et al., 2006). A social support measure in a study where participants work together on a daily basis could add valuable information in future studies utilizing MBSR-ld.

### IMPLICATIONS FOR PRACTITIONERS

MBSR-ld abbreviated the weekly and daily time commitment of traditional MBSR and still obtained significant decreases in perceived stress and improvements in quality of sleep while increasing daily mindfulness for healthy working adults. From an applied perspective, this study indicates that MBSR-ld is an effective adaptation of the MBSR approach for healthy working individuals limited by time. Adapting a well-researched stress reduction intervention (MBSR) for the workplace may be a starting place for further research using MBSR-ld as a low-cost stress reduction intervention with a relatively high rate of adherence. Even though there is an abundance of information on the impact of stress on one's well-being, MBSR-ld is a tool that participants can experience firsthand and use to explore the personal impact of a stress reduction program on their stress levels.

Offering the intervention on site, with often-cited limitations eliminated, may indicate that MBSR-ld is a viable, innovative approach for employers looking to reduce stress-related health care costs. Although MBSR-ld was developed to address the real-time limitations experienced by working adults, future research could investigate if MBSR-ld affects health expenditures associated with stress-induced illness. MBSR-ld may be an appropriate low-cost clinical intervention capable of achieving desired stress reduction for healthy working adults.

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