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Mindfulness-Based Stress Reduction Among Breast Cancer Survivors: A Literature Review and Discussion

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Breast cancer is the second-most common cancer among women in the United States, with an estimated 207,180 new cases of invasive breast cancer diagnosed in 2010 (American Cancer Society, 2010). As advances in medical treatment have led to increases in the number of breast cancer survivors, many are now facing the challenge of long-term coping. A cancer diagnosis is a stressful phenomenon and a life-threatening experience that creates immediate psychosocial distress for the patient and his or her family (Sellick & Edwardson, 2007). Distress is experienced by patients with cancer across diagnoses and across the disease trajectory (Carlson, Angen, et al., 2004). Half of all patients suffer from psychological distress related to the disease itself, side effects, the financial cost of cancer treatment, and the general uncertainty in their lives. Based on gender, women met the criteria of acute stress disorder (ASD) following diagnosis of cancer in greater numbers than men (McGarvey et al., 1998). Predictors for ASD in women with cancer include being of a younger age, having no prior life-threatening illness, perceiving less social support from friends and family members, and reporting less satisfaction with how they were informed about the diagnosis (McGarvey et al., 1998).

Mindfulness-based stress reduction (MBSR), a meditation program widely used in research and clinical settings, has been shown to be beneficial for nonclinical and clinical populations, including patients with cancer (Dobkin, 2008). Application involves coping with stress, distress, pain, and illness, as well as increasing degrees of equanimity, wisdom, and compassion (Reibel, Greeson, Brainard, & Rosenzweig, 2001). This review will focus on the effect of MBSR on breast cancer survivors because breast cancer is a specific clinical condition and the response of survivors to MBSR on some variables may be different from other oncology diagnoses.

Purpose/Objectives: To evaluate and discuss existing studies of mindfulness-based stress reduction (MBSR) among breast cancer survivors.

Data Sources: Articles published from 1987–2009 were retrieved using MEDLINE®, CINAHL®, Ovid, and Scopus. Key words, including *mindfulness-based stress reduction* and *mindfulness meditation*, were combined with *breast cancer*.

Data Synthesis: The search resulted in 26 articles that were narrowed down to 16 by selecting only quantitative studies of MBSR conducted with breast cancer ($n = 7$) or heterogeneous types of cancer in which the predominant cancer was breast cancer ($n = 9$). Most studies were one-group pre- and post-test design and examined the effect of MBSR on psychological outcomes. Overall, the studies had large effect sizes on perceived stress and state anxiety and medium effect sizes on symptoms of stress and mood disturbance. Four studies measured biologic outcomes and had small effect sizes, except cytokine production, which showed a large effect size at 6- and 12-month follow-ups.

Conclusions: Future studies using randomized, control trials and longitudinal, repeated-measures designs are needed. Studies conducted with heterogeneous types of cancer and gender should be analyzed and the results reported separately.

Implications for Nursing: The comprehensive summary and critical discussion of existing studies of MBSR usage among breast cancer survivors provide essential information that can be used by nurses and others working in the healthcare setting.

Breast Cancer and Related Distress

A cancer diagnosis elicits greater distress than any other diagnosis, regardless of the prognosis (Tacon, Caldera, & Ronaghan, 2005). Women with breast cancer experience emotional distress and mood disturbances, such as anxiety, confusion, and depression; worry about recurrence; and have a decreased sense of well-being (Boehmke & Dickerson, 2006). Many potential sources

can cause distress for women with a breast cancer diagnosis, including the diagnosis itself, anticipation of suffering, taxing treatment regimens, difficulty coping with life changes, and adjusting to the inherent uncertainty and uncontrollability of the illness (Boehmke & Dickerson, 2006; Mackenzie, Carlson, Munoz, & Specia, 2007). The distress decreases breast cancer survivors' sense of well-being and quality of life. Classen et al. (2001) indicated that 22%–50% of patients with breast cancer meet the criteria for a psychiatric diagnosis of depression, 3%–19% meet the criteria for post-traumatic stress disorder (PTSD), and 33% meet the criteria for ASD. The distress regarding diagnosis and treatment of breast cancer disrupts virtually every aspect of a woman's emotional well-being, family life, and career (Alferi, Carver, Antoni, Weiss, & Duran, 2001). In addition, feelings of loneliness after women are diagnosed with breast cancer often are a result of difficulty in maintaining established relationships with others (Wolberg, Romsaas, Tanner, & Malec, 1989). Although distress symptoms in some women with breast cancer might not be as frequent or intense as full PTSD, these symptoms can seriously impair an individual's quality of life and well-being (Amir & Ramati, 2002). Traumatic stress symptoms in women with breast cancer are greater in frequency among those who are younger, who receive postsurgical cancer treatment, who are low in emotional self-efficacy, and whose lives are most affected by having cancer (Koopman et al., 2002).

Mindfulness Meditation

Mindfulness meditation is a practice of training concentrated attention by focusing on a sound, object, visualization, breath, movement, or attention itself to increase awareness of the present moment, reduce stress, promote relaxation, and enhance personal and spiritual growth (Weymouth, 2007). Mindfulness meditation originated in Eastern practice as the method the Buddha taught as part of the means of ending suffering (Bonadonna, 2003). Through practicing meditation, an individual can be focused on the present, not thinking about the past or worrying about the future. At this point, the individual can end his or her suffering. To build and maintain mindfulness, one is required to practice these specific skills over and over again. Therefore, the ability to direct one's attention in this way can be developed through the practice of meditation, which is defined as the intentional self-regulation of attention from moment to moment (Baer, 2003).

Kabat-Zinn (1994), a scientist, writer, and meditation teacher who developed the MBSR program, defined mindfulness meditation as "bringing one's complete attention to the present experience on a moment-to-moment basis" and "as paying attention in a particular

way: on purpose, in the present moment, and nonjudgmentally" (p. 4). The MBSR program was introduced as an intervention that is free from religions and cultures. The power of mindfulness lies in its practice and applications (Kabat-Zinn, 2003).

Types of Meditation Techniques

A variety of meditation techniques are associated with different traditions (Valentine & Sweet, 1999); however, these techniques share many common outcomes, such as equanimity, detachment, and clearer sensory perceptions (Bonadonna, 2003). Based on the ways of paying attention, two broad types of meditation techniques exist: concentrative meditation and mindfulness meditation (Brown, 1977). For concentrative meditation, one can focus any of the senses on a very specific object or a single point—"one-pointedness" or "zoom lens attention" (Ott, 2004). With this practice, an individual learns how to cultivate one point of attention by focusing on a mantra, sound, visual image, or object. For example, in transcendental meditation, practitioners are taught to repeat a sound or phrase to focus and concentrate the mind to cut off discursive thinking.

The second basic type is mindfulness meditation, also known as insight meditation. The skill in practice is like a wide-angle lens; an attempt is made to expand awareness to events exactly as they occur in each moment of the whole perceptual field (Valentine & Sweet, 1999). Attention is receptive to the whole field of awareness and remains in an open state; therefore, one can direct his or her attention to currently experienced sensations, thoughts, emotions, and memories. Practitioners are taught to sit comfortably, in silence, train their attention by focusing mental awareness on an object or process (i.e., a breathing process, sound, or visualization), and consciously scan their thoughts in an open focus, shifting freely from one perception to the next. The aim is to become aware of each type of event at the moment it occurs for as long as the event is present in the realm of consciousness.

In the practice of mindfulness meditation, no thought, image, or sensation is considered an intrusion. The extension of awareness to a variety of events constitutes mindfulness. The emphasis of this practice is maintaining a detached, noninterpretative, nonjudgmental observation of the processes by which events enter awareness (Valentine & Sweet, 1999). Practitioners are instructed to use the actual event of each present moment as an anchor to pay attention constantly without analysis or judgment of the contents of awareness (Teasdale, Segal, & Williams, 1995); paying attention on purpose to what is happening in the present moment, with no other goals; and being open to, curious about, and aware of one's own experience in the moment and not making judgments, developing plans, or strategizing (Ott,

2004). Phenomena that enter the individual's awareness during mindfulness practice, such as perceptions, cognitions, emotions, or sensations, are observed carefully but are not evaluated as good or bad, true or false, healthy or sick, or important or trivial (Baer, 2003). Regardless of many similar outcomes of these two meditation techniques, mindfulness meditators tend to deal with unexpected situations better than concentrative meditators (Valentine & Sweet, 1999).

Mindfulness-Based Stress Reduction

MBSR is the most common mindfulness-inspired therapy (Baer, 2003). The MBSR program was developed by Kabat-Zinn (1982) at the University of Massachusetts Medical Center in 1979. MBSR is a specific, highly structured psychoeducational and skill-based therapy intervention that combines mindfulness meditation with Hatha yoga exercises, body scan, and discussion of stress and coping. For all mindfulness exercises, participants are instructed to focus attention on the target of observation (e.g., breathing, pleasant, unpleasant, neutral feeling tone, bodily sensation, thoughts). When emotions, sensations, or cognitions arise, participants are taught to observe them nonjudgmentally. When the participant notices that the mind has wandered into thoughts, memories, or fantasies, the nature or content of them is noted briefly, and then attention is returned to the object of focus (e.g., breathing). Participants are taught to notice their thoughts, sensations, and feelings but not to become absorbed in their content (Kabat-Zinn, 1982). The MBSR program is intended as a training vehicle for the relief of suffering in a variety of conditions and to complement medical treatments (Kabat-Zinn, 2003).

Literature Review

Methods

Articles published in English from 1982–2009 were retrieved using MEDLINE®, CINAHL®, Ovid, and Scopus. Searches used combinations of *mindfulness-based stress reduction*, *mindfulness meditation*, and *breast cancer*. The search resulted in 26 articles that were narrowed further to 16 by selecting only quantitative studies of MBSR conducted with women with breast cancer ($n = 7$) or heterogeneous types of cancer in which the predominant cancer was breast cancer ($n = 9$). Each article was read carefully, critiqued, and summarized in Table 1 along with calculated effect sizes. The findings were reviewed and discussed with two other members of the research team.

Seven studies examined the effect of MBSR on breast cancer survivors alone. One study (Dobkin, 2008) used a mixed-method, quantitative and qualitative design conducted with 13 patients; two studies used one-group

pre- and post-test design (Tacon et al., 2004, 2005); three studies used a randomized, controlled trial (Hebert et al., 2001; Lengacher et al., 2009; Shapiro, Bootzin, Figueredo, Lopez, & Schwartz, 2003); and one study (Witek-Janusek et al., 2008) used a nonrandomized, controlled trial with three-group comparison of MBSR, non-MBSR, and healthy women. Sample sizes ranged from 13–157 participants. The majority studied variables focused on psychological outcomes, such as mood disturbance, depression, anxiety, symptoms of stress, and quality of life. Witek-Janusek et al. (2008) also measured biologic outcomes, including mononuclear cell, natural killer cell, cytokine production, and plasma cortisol levels pre-, mid-, and post-MBSR and at one-month follow-up. Six studies were conducted in the United States and one study was conducted in Canada (Dobkin, 2008). One study conducted a follow-up measurement 12 months after the intervention completion (Hebert et al., 2001).

Nine studies were conducted with patients with heterogeneous types of cancer in which the predominant one was breast cancer (see Table 1). Seven of nine studies were one-group pre- and post-test design; sample sizes of these studies ranged from 41–89 participants. One study was a nonrandomized comparison (Garland, Carlson, Cook, Lansdell, & Specia, 2007) and one was a randomized, wait-list controlled clinical trial (Specia, Carlson, Goodey, & Angen, 2000). Sample sizes of randomized and nonrandomized controlled trials ranged from 90–104 participants. Studied variables focused on psychological outcomes such as stress, mood disturbance, and quality of life. Three of the nine studies also assessed biologic variables, including salivary cortisol, endocrine, immune, cell count, melatonin, dehydroepiandrosterone-sulfate (DHEAS), and autonomic parameters (Carlson, Specia, Faris, & Patel, 2007; Carlson, Specia, Patel, & Goodey, 2003, 2004). Most importantly, these three studies were conducted with the same group of samples: 49 patients with breast cancer and 10 patients with prostate cancer; however, some variables were presented as a unique variable in each study. Seven of nine studies were conducted in Canada, one study was conducted in the United States, and one study was conducted in the Netherlands. Three studies (Carlson et al., 2007; Carlson, Ursuliak, Goodey, Angen, & Specia, 2001; Kieviet-Stijnen, Visser, Garssen, & Hudig, 2008) conducted follow-up measurements at 6 or 12 months.

Findings indicated that MBSR is effective in promoting sleep quality and quality of life and decreasing stress, distress, state anxiety, and mood disturbance for breast cancer survivors. These effects were maintained at 6- and 12-month follow-ups. The MBSR also showed effects on improving immune function and decreasing blood pressure in the samples (see Table 2). However, the effect of MBSR on biologic outcomes was drawn based on only a few studies with one-group pre- and

Table 1. Studies of MBSR Among Breast and Other Cancer Survivors

Study	Participants	Design	Measure and Effect Size	Findings
Breast Cancer Only				
Dobkin, 2008	13 Canadian women with breast cancer who had completed medical treatment	Mixed method using quantitative and qualitative approaches	CES-D (0.655), Medical Symptom Checklist (0.904), Perceived Stress Scale (1.1), Sense of Coherence (0.44), Mindful Attention Awareness Scale (0.562), and Coping With Health Injuries and Problems (0.27)	Significantly improved in the use of palliative coping and mindfulness and decreased in perceived stress and medical symptoms. Qualitative themes were reported as acceptance, regaining and sustaining mindful control, taking responsibility for what could change, and spirit of openness and connectedness.
Hebert et al., 2001	157 U.S. women with stage I or II breast cancer	A randomized, controlled trial concerning a nutrition education program (n = 50), an MBSR clinic program (n = 51), and usual care (n = 56). Follow-up measurement was conducted at 12 months.	Total energy, total fat, complex carbohydrates, fiber, body mass, Beck Depression Inventory, self-esteem scale, general symptom checklist, and seven-day diet recall ^a	The nutrition education program group experienced a large reduction in fat consumption at 4 months, and much of this reduction was preserved at 12 months, whereas no change was found in either the stress reduction or usual care groups. A 1.3 kg reduction in body mass was evident at 4 months in the nutrition education group, whereas no change was observed in the stress reduction and usual care groups. The stress reduction group did not receive information about selecting and preparing food. Psychological outcomes were measured, but results were not discussed or reported.
Lengacher et al., 2009	84 U.S. women with stage 0–III breast cancer	A randomized, controlled trial focusing on MBSR (n = 41) and usual care (n = 43) groups	STAI, Concerns About Recurrence Scale, CES-D, Life Orientation Test, Perceived Stress Scale, Medical Outcomes Studies Short Form General Health, and Medical Outcomes Social Support Survey on Spirituality ^a	The MBSR group had significantly lower adjusted mean levels of depression, anxiety, and fear of recurrence, along with higher energy, physical functioning, and physical role functioning. More compliance with MBSR was associated with improvements in energy and physical functioning.
Shapiro et al., 2003	63 U.S. women with stage II breast cancer	Randomized, controlled trial of MBSR (n = 31) and free choice (n = 32) groups	POMS, Beck Depression Inventory, Penn State Worry Questionnaire, STAI, FACIT–Breast, Shapiro Control Inventory, Sense of Coherence, and a sleep diary ^a	Significant improvement on daily diary sleep quality was found in both MBSR and free choice; neither improved on sleep efficiency. Greater mindfulness practice was associated with higher sleep quality.
Tacon et al., 2004	27 U.S. women with breast cancer	One-group pre- and post-test design	Self-rated stress (1.657), STAI (1.408), Mental Adjustment to Cancer Scale (0.328), and Multidimensional Health Locus of Control Scale (0.467)	Significant decreases were observed on stress and state anxiety as well as significant improvement for mental adjustment to cancer and health locus of control.
Tacon et al., 2005	30 U.S. women with breast cancer	One-group pre- and post-test design	STAI (1.36), Problem-Focused Styles of Coping (0.422), and Mental Adjustment to Cancer (0.33)	Significant decreases were observed on anxiety, reactive and suppressive coping styles, as well as two scales of mental adjustment: helpless hopelessness and anxious preoccupation.

(Continued on the next page)

^aNo data for calculating effect size

^bEffect sizes are post-MBSR and at 6 months, respectively.

^cEffect sizes are post-MBSR, at 6 months, and at 12 months, respectively.

^dEffect sizes are post-MBSR and at 12 months, respectively.

CES-D—Center for Epidemiologic Studies–Depression; EORTC QLQ—European Organisation for Research and Treatment of Cancer Quality-of-Life Questionnaire; FACIT—Functional Assessment of Chronic Illness Therapy; MBSR—mindfulness-based stress reduction; POMS—Profile of Mood States Scale; PTGI-R—Post-Traumatic Growth Inventory–Revised; SOSI—Symptoms of Stress Inventory; STAI—State-Trait Anxiety Inventory; VAS—visual analog scale

Table 1. Studies of MBSR Among Breast and Other Cancer Survivors (Continued)

Study	Participants	Design	Measure and Effect Size	Findings
Witek-Janusek et al., 2008	66 U.S. women with stage 0–II breast cancer self-selected to either MBSR or non-MBSR	A nonrandomized controlled trial of MBSR (n = 38), non-MBSR (n = 28), or cancer free (n = 30)	Quality of Life Index–Cancer (0.597); Jalowiec Coping Scale (0.667), optimistic subscale (0.807), supportant subscale (0.527); and Mindful Attention Awareness Scale (no significant change)	The MBSR group reestablished their immune function, natural killer cell activity, and cytokine production, whereas the non-MBSR group exhibited reductions in natural killer cell activity and interferon- γ production with increased interleukin-4, -6, and -10 production. In addition, the MBSR group had significantly reduced cortisol levels, improved quality of life, and increased coping effectiveness.
Heterogeneous Types, Mostly Focusing on Breast Cancer				
Brown & Ryan, 2003	Patients with early-stage breast (n = 32) and prostate cancer (n = 9) in the United States	One-group pre- and post-test design	Mindful Attention Awareness Scale, POMS, SOSI, and EORTC QLQ–Core 30 ^a	Significantly decreased on stress. Neither Mindful Attention Awareness Scale nor POMS scores showed a significant change. The increase of Mindful Attention Awareness Scale was associated with the decrease of the POMS and the SOSI.
Carlson et al., 2001	89 Canadian patients with heterogonous types and stages of cancer	One-group pre- and post-test design and follow-up at six months	POMS (0.51, 0.806) and SOSI (0.497, 0.422) ^b	Significant decreases were observed on POMS and SOSI scores, which were maintained at the six-month follow-up, but not significant. More advanced stages of cancer were associated with less initial mood disturbance, whereas more home practice and higher initial POMS scores predicted improvements on the POMS from pre- to postintervention scores.
Carlson et al., 2003	Canadian patients with early-stage breast cancer (n = 49) and prostate cancer (n = 10)	One-group pre- and post-test design	EORTC QLQ–Core 30 (0.209), function scale (0.266), symptom scale (0.153); POMS (0.064); and SOSI (0.353)	Significant improvements were observed in overall quality of life, symptoms of stress, and sleep quality. No significant changes were found for lymphocytes count or mood disturbance.
Carlson, Speca, et al., 2004	Canadian patients with early-stage breast cancer (n = 49) and prostate cancer (n = 10)	One-group pre- and post-test design	EORTC QLQ–Core 30 (0.505), POMS (0.273), and SOSI (0.474)	Significant improvements were seen in overall quality of life, symptoms of stress, and sleep quality. No significant improvements were found in mood disturbance. Improvements in quality of life were associated with decrease in afternoon cortisol.
Carlson et al., 2007	Canadian patients with early-stage breast cancer (n = 49) and prostate cancer (n = 10)	One-group pre- and post-test design and follow-up at 6 and 12 months	EORTC QLQ–Core 30 (0.26, 0.08, 0.29), POMS (0.00, 0.01, 0.16), and SOSI (0.28, 0.3, 0.4) ^c	Significant improvements in overall symptoms of stress were maintained over the follow-up period. Cortisol levels decreased over the course of the follow-up. Immune function improved. Systolic blood pressure decreased.

(Continued on the next page)

^aNo data for calculating effect size^bEffect sizes are post-MBSR and at 6 months, respectively.^cEffect sizes are post-MBSR, at 6 months, and at 12 months, respectively.^dEffect sizes are post-MBSR and at 12 months, respectively.

CES-D—Center for Epidemiologic Studies–Depression; EORTC QLQ—European Organisation for Research and Treatment of Cancer Quality-of-Life Questionnaire; FACIT—Functional Assessment of Chronic Illness Therapy; MBSR—mindfulness-based stress reduction; POMS—Profile of Mood States Scale; PTGI-R—Post-Traumatic Growth Inventory–Revised; SOSI—Symptoms of Stress Inventory; STAI—State-Trait Anxiety Inventory; VAS—visual analog scale

Table 1. Studies of MBSR Among Breast and Other Cancer Survivors (Continued)

Study	Participants	Design	Measure and Effect Size	Findings
Carlson & Garland, 2005	63 Canadian patients with heterogonous types and stages of cancer, predominantly breast cancer	One-group pre- and post-test design	Pittsburgh Sleep Quality Index (0.602), SOSI (0.437), and POMS (0.573)	Significant decreases were reported on overall sleep disturbance, stress, mood disturbance, and fatigue. Changes in stress and mood disturbance were associated with fatigue.
Garland et al., 2007	104 Canadian patients with heterogonous types and stages of cancer, predominantly breast cancer. Participants were self-selected to 8 weeks of MBSR (n = 60) or 6 weeks of Healing Through the Creative Arts (n = 44)	Nonrandomized comparison design	Between groups: PTGI-R (0.459), FACIT–Spiritual Well-Being (0.443), SOSI (0.414), and POMS (0.461) Pre- and post-MBSR: PTGI-R (0.282), FACIT–Spiritual Well-Being (0.408), SOSI (0.496), and POMS (0.441)	Participants in both groups improved significantly over time on overall post-traumatic growth. Participants in the MBSR group improved on measures of spirituality, anxiety, anger, overall stress symptoms (in the SOSI), and overall mood disturbance (in the POMS) more than those in the healing group.
Kieviet-Stijnen et al., 2008	47 patients with cancer, predominantly breast cancer, from the Netherlands	One-group pre- and post-test design and follow-up at 12 months	VAS (0.439, 0.465), Rotterdam Symptom Checklist (0.36, 0.4), POMS (0.286, 0.596), Health and Disease Inventory (0.25, 0.533), and a self-report scale measuring experienced meaning in life (0.00, 0.2) ^d	Significantly improved on quality of life, more joy in life, less tension, and fewer physical symptoms. A year later, a decrease was found in depression, anger, vigor, and total mood disturbance. No changes could be found for meaning in life and fatigue.
Specia et al., 2000	90 Canadian patients with heterogonous types and stages of cancer, predominantly breast cancer, taking part in MBSR (n = 53) or being placed on a wait list (n = 37)	Randomized, wait-list, controlled clinical trial	Between groups: POMS (0.819) and SOSI (0.607) Pre- and post-MBSR: POMS (0.717) and SOSI (0.782)	The MBSR group had significantly lower scores on total mood disturbance and subscales of depression, anxiety, anger, and confusion and more vigor than control subjects, and also had fewer overall symptoms of stress; fewer cardiopulmonary and gastrointestinal symptoms; less emotional irritability, depression, and cognitive disorganization; and fewer habitual patterns of stress.

^aNo data for calculating effect size

^bEffect sizes are post-MBSR and at 6 months, respectively.

^cEffect sizes are post-MBSR, at 6 months, and at 12 months, respectively.

^dEffect sizes are post-MBSR and at 12 months, respectively.

CES-D—Center for Epidemiologic Studies–Depression; EORTC QLQ—European Organisation for Research and Treatment of Cancer Quality-of-Life Questionnaire; FACIT—Functional Assessment of Chronic Illness Therapy; MBSR—mindfulness-based stress reduction; POMS—Profile of Mood States Scale; PTGI-R—Post-Traumatic Growth Inventory–Revised; SOSI—Symptoms of Stress Inventory; STAI—State-Trait Anxiety Inventory; VAS—visual analog scale

post-test design. Therefore, conclusions and applications should be considered cautiously.

Effect Sizes

Most studies examined the effect of MBSR on psychological outcomes with a one-group pre- and post-test design. Twelve of 16 studies reported data for calculating effect size. For studies of one-group pre- and post-test design, effect sizes were calculated by dividing the difference in mean scores between pre- and postintervention with the pooled SD of the two time points. For studies that included control groups, effect sizes were calculated by dividing the difference of mean scores of pre- and postintervention between the two groups with the pooled SD of the two groups. The calculation of effect sizes used the formulas described by Rosenthal (1991). When means and SD were not reported, effect sizes were calculated from F values such as biologic outcomes in Witek-Janusek et al. (2008). Cohen (1992) suggested that effect sizes of 0.2 are small, 0.5 are medium, and 0.8 are large. Studies of MBSR with small sample sizes tended to have small effect sizes. Three studies that measured state anxiety and perceived stress (Dobkin, 2008; Tacon et al., 2004, 2005) reported large effect sizes (greater than 1). These effect sizes were larger than the average effect size of state anxiety and perceived stress in studies of MBSR with other groups (a range of 0.34–0.94 was reported by Carmody and Baer [2009]). Some studies obtained smaller effect sizes post-MBSR but had larger effect sizes at the 6- or 12-month follow-ups (Carlson et al., 2001; Kieviet-Stijnen et al., 2008). Mindful attention awareness had a medium effect size in one study (Dobkin, 2008) and showed nonsignificant change in two other studies (Brown & Ryan, 2003; Witek-Janusek et al., 2008). One study assessed the effect of MBSR on psychological outcomes but did not analyze or report on it in the article (Hebert et al., 2001).

Mindfulness-Based Stress Reduction and Biologic Outcomes

Four studies examined the effect of MBSR on biologic outcomes. The dependent variables included immune profile, blood pressure, heart rate, cortisol level, and melatonin levels. Only variables with

statistical significance are presented in this review. Most variables had small effect sizes (less than 0.5), except cytokine production (interferon- λ , tumor necrosis factor, and interleukin-4), which had a large effect size (greater than 1) at 6- and 12-month follow-ups. Interestingly, studies that included participants with breast and prostate cancer (Carlson, Speca, et al., 2004) revealed that these two groups responded to MBSR in different ways on some biologic outcomes. For example, male cortisol levels increased at 2 pm (Carlson, Speca, et al., 2004), whereas female cortisol levels decreased. In con-

Table 2. Effect Sizes of MBSR on Biologic Outcomes

Study	Biologic Outcomes	Effect Size		
		Post-MBSR	At 6 Months	At 12 Months
Carlson et al., 2007	Total lymphocytes increase	0.169	0.183	0.103
	CD3 (% lymph) decrease	0.038	0.309	0.279
	CD4 (% lymph) decrease	0.098	0.122	0.029
	then increase			
	CD8 (% lymph) decrease	0.041	0.239	0.24
	CD19 (% lymph) increase	0.04	0.193	0.215
	CD56 (% lymph) increase	0.12	0.169	0.195
	then decrease			
	Cytokines (% of T cells)			
	IFN- λ decrease	0.004	1.235	1.291
	TNF decrease	0.098	1.064	1.463
	IL-4 decrease	0.004	1.014	1.835
	IL-10 decrease	0.231	0.073	0.105
	SBP decrease	0.128	0.411	0.313
	DBP decrease	0.207	0.232	0.456
	Heart rate decrease	0.267	0.149	0.519
Carlson, Speca, et al., 2004	Total cortisol decrease	0.087	—	—
	Women cortisol decrease	0.078	—	—
	Total cortisol at 2 pm decrease	0.149	—	—
	Men cortisol at 2 pm increase	0.048	—	—
	Women cortisol at 2 pm decrease	0.184	—	—
	Total melatonin decrease	0.171	—	—
	Men melatonin decrease	0.95	—	—
	Women melatonin increase	0.003	—	—
Carlson et al., 2003	Monocytes (percent of WBC) decrease	0.293	—	—
	Eosinophils (percent of WBC) increase	0.31	—	—
	IFN- λ T (% lymph) decrease	0.33	—	—
	IL-4 T (% lymph) increase	1.007	—	—
	IL-10 NK (% lymph) decrease	0.375	—	—
Witek-Janusek et al., 2008	NKCA increase	0.472	—	—
	Product of IFN- λ increase	0.437	—	—
	IL-4 decrease	0.459	—	—
	IL-6 decrease	0.571	—	—
	IL-10 increase	0.309	—	—
	Plasma cortisol (4–6 pm) decrease	0.572	—	—

DBP—diastolic blood pressure; IFN- λ —interferon gamma; IL—interleukin; MBSR—mindfulness-based stress reduction; NK—natural killer; NKCA—natural killer cell activity; SBP—systolic blood pressure; TNF—tumor necrosis factor; WBC—white blood cell

trast, male melatonin levels decreased with large effect size (0.95), whereas female melatonin increased. These findings suggest that studies including both genders or heterogeneous types of cancer should be analyzed and the results reported separately because these factors may cause participants to respond to the intervention differently. In a study of a healthy sample, the effect size of mindfulness meditation on decreasing cortisol level was found to be 0.8 (Tang et al., 2007). In a study of individuals who had long-term experience with meditation, findings showed higher levels of DHEAS and lower levels of cortisol compared to healthy controls. For women with long meditative experience, decreased cortisol levels and increased DHEAS levels correlated with the number of months of meditation practice (Walton, Pugh, Gelderloos, & Macrae, 1995). This is a positive outcome of mindfulness meditation.

Discussion

Study Design

As reported, findings indicated that future studies with solid designs (i.e., randomized, controlled trials and longitudinal studies with repeated-measures design) are needed in this area. In addition, integrating qualitative approaches seems to be useful in exploring effects of MBSR. In some studies, although quantitative methods could not detect significant changes in some qualitative aspects, participants reported great satisfaction and reaching their goals with the training: coping with their illness, finding inner tranquility, and raising self-esteem (Kieviet-Stijnen et al., 2008). Participants in Dobkin (2008) described that, at a deeper level, they came to an acceptance of what is. This point was not captured in the quantitative measure, suggesting that research using mixed methods might be useful. Likewise, the study of Witek-Janusek et al. (2008) found no change on the Mindful Attention Awareness Scale but had a large effect size on the optimistic subscale of the Jalowiec Coping Scale. Similarly, Tacon et al. (2004, 2005) obtained a small effect size on mental adjustment to cancer, but a large effect size on the results of the State-Trait Anxiety Inventory. In addition, some instruments included multiple subscales that had either large or small effect sizes. The average effect sizes were small or medium (e.g., Coping with Health Injuries and Problems [Dobkin, 2008], Jalowiec Coping Scale [Witek-Janusek et al., 2008]), suggesting that some subscales may not fit with the MBSR intervention. Therefore, using multiple instruments may be more reliable.

Time in Practice and Mindfulness Skills

Time in practice and classes attended were discussed in some studies. Carlson et al. (2001) reported more

home practice being associated with a greater magnitude of improvement in mood. This finding was consistent with that of Specia et al. (2000), who found that the number of minutes in practice and the number of sessions attended significantly predicted change scores of mood disturbance and symptoms of stress. These two studies were conducted with the same sample (N = 89), of whom 43% were breast cancer survivors. In contrast, time used in practice was reported to have no relation with stress change scores from pre- to postintervention (Carlson, Specia, et al., 2004) and in the 6- and 12-month follow-up with 59 participants, of whom 83% were breast cancer survivors (Carlson et al., 2007). In a review of MBSR conducted with other samples, assigned practice time did not correlate with the improvement of psychological distress (Carmody & Baer, 2009). Most interestingly, among types of mindfulness practice, total minutes of sitting meditation and body scan were significantly related to positive changes in several measures of psychological status and quality of life, whereas total minutes of walking meditation were associated with positive changes in fear of recurrence and physical functioning. In contrast, total minutes of practicing yoga was not significantly related to positive changes in psychological status or quality of life (Lengacher et al., 2009). This finding of the practice of yoga is contrary to a study of MBSR with 206 individuals where samples included illness-related stress, chronic pain, anxiety, and personal- and employment-related stress (Carmody & Baer, 2008). In this study, yoga practice was reported to be significantly associated with improvement in four of five mindfulness facets (observe, act with awareness, nonjudge, and nonreact), well-being, perceived stress levels, and several types of psychological symptoms (Carmody & Baer, 2008). In addition, all mindfulness skills, including sitting meditation, body scan, and yoga, were reported to be significantly associated with psychological well-being in a study of 206 individuals (Carmody & Baer, 2008).

Demographic Characteristics and Behaviors

Some demographic characters and behaviors seem to influence the effects of MBSR. Carlson et al. (2007) found that a lack of significant changes in mood disturbance scores post-MBSR might be a result of the low level of initial mood disturbance that related to participants' characteristics, such as age, education, and time after diagnosis. Participants in Carlson et al. (2007) had been diagnosed with cancer a median of 2.05 years, had a mean age of 54.5 years, and were well educated. As reported by Koopman et al. (2002), the highest traumatic stress of women with breast cancer occurred right after the diagnosis; women at greatest risk were those who are younger, who receive postsurgical cancer treatment,

who are low in emotional self-efficacy, and whose lives are most affected by having cancer. In Carlson et al. (2007), the duration of two years after diagnosis along with education level might allow women to cope well, as reflected in a low score on initial mood disturbance. Ganz et al. (1996) reported that breast cancer survivors appeared to attain maximum recovery from the physical and psychological trauma of cancer by 12 months after treatment. Level of education was found to be significantly associated with higher initial scores and changes in total scores of symptoms of stress from pre- to post-MBSR, suggesting that those with more education reported more symptoms of initial stress and improved more after the intervention (Carlson et al., 2001). Carlson et al. (2003) also found that those having more recent diagnoses had higher mood disturbance scores. Surprisingly, patients with more advanced stages of cancer were found to have less initial mood disturbance (Carlson et al., 2001). The authors postulated that those with a more advanced stage of cancer had been forced to deal with issues of death and dying and can accept these conditions more than those with an earlier stage. Lengacher et al. (2009) assessed comorbid disease and medication taken but did not include these variables in the analysis of the effect of MBSR. In a qualitative study with psychiatric patients, the use of sedative medication was reported as an obstacle for engaging in mindfulness practice (York, 2007). Carlson, Specia, et al. (2004) found that changes in symptoms of stress or mood disturbance were not related to changes in hormone levels in a sample of breast and prostate cancer survivors. This finding is consistent with a report that a higher association between levels of depressive symptomatology and cortisol response after awakening was found in a nonclinical sample (Pruessner, Hellhammer, Pruessner, & Lupien, 2003).

Few studies discussed qualifications of MBSR practitioners and types of mindfulness practice that each emphasized the most. Both of these may affect participants' psychological outcomes.

Conclusion

From 2000–2009, 16 quantitative studies of MBSR conducted with breast cancer survivors or heterogeneous

types of cancer in which the predominant cancer was breast cancer were published. Four of the studies used a randomized, controlled design. Four studies conducted follow-up measurements at 6 and 12 months. The majority of participants were early-stage breast cancer survivors. Most dependent variables were psychological outcomes, such as perceived stress and state anxiety that had large effect sizes. Four studies assessed biologic outcomes, and most had small effect sizes. Studies conducted with heterogeneous types of cancer and gender showed different outcomes on separate analyses. Few studies examined and discussed the effect of each type of mindfulness practice in this sample. A need exists for future research with rigorous designs (as well as mixed methods) and longitudinal studies in this area. In addition, it might be useful to promote MBSR using instructions on a CD or DVD for patients with a later stage of cancer or with a chronic illness that prevents them from attending classes.

Implications for Nursing

With its promising outcomes, MBSR programs currently are offered in healthcare settings around the world (Ott, Norris, & Bauer-Wu, 2006). Stress, distress, and other psychological issues are important among patients with cancer. As a self-care practice that can be done anywhere and at any time with modest cost, mindfulness meditation should be implemented more widely in oncology settings. Understanding its concepts, benefits, and applications may help nurses and other healthcare providers become more confident to promote and discuss this self-care practice with survivors. This review, including critical discussion of the effect of MBSR among breast cancer survivors, provides essential information for oncology nurses and others working in this area.

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