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Mindfulness based stress reduction in post-treatment breast cancer patients: an examination of symptoms and symptom clusters

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Abstract To investigate prevalence and severity of symptoms and symptom clustering in breast cancer survivors who attended MBSR(BC). Women were randomly assigned into MBSR(BC) or Usual Care (UC). Eligible women were $\geq$ 21 years, had been diagnosed with breast cancer and completed treatment within 18 months of enrollment. Symptoms and interference with daily living were measured pre- and post-MBSR(BC) using the M.D. Anderson Symptom Inventory. Symptoms were reported as highly prevalent but severity was low. Fatigue was the most frequently reported and severe symptom among groups. Symptoms clustered into 3 groups and improved in both groups. At baseline, both MBSR(BC) and the control groups showed similar mean symptom severity and interference; however, after the 6-week post-intervention, the MBSR(BC) group showed statistically-significant reduction for fatigue and disturbed sleep ($P < 0.01$) and improved symptom interference items, compared to the control group. For the between-group comparisons, 11 of 13 symptoms and 5 of 6 interference items had lower means in the MBSR(BC) condition than the control condition. These results suggest that MBSR(BC) modestly decreases fatigue and sleep disturbances, but has a greater effect on the degree to which symptoms interfere with many facets of life. Although these results are preliminary, MBSR intervention post-treatment may effectively reduce fatigue and related interference in QOL of breast cancer survivors.

Keywords MBSR · Breast cancer · Symptom clusters

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Introduction

Women with breast cancer report numerous symptoms either from the disease itself or as a result of treatment. Psychological symptoms of stress, anxiety, depression, fear of recurrence, and impaired cognitive functioning and physical symptoms of pain, fatigue and sleep disturbances continue after treatment ends (Dodd et al., 2001; Esper & Heidrich, 2005) which negatively impacts their quality of life (QOL) (Bower et al., 2000; Byar et al., 2006; Ganz et al., 2002, 2003; Gelinas & Fillion, 2004; Kenefick, 2006; Kornblith et al., 2003; Lee et al., 2004b; Servaes et al., 2002).

Symptoms tend to cluster together and may have natural associations, similar shared pathways, and underlying mechanisms (Francoeur, 2005). Symptom clusters are defined as 2 or more concurrent symptoms related to one another and independent of other symptoms (Barsevick, 2007; Cleeland et al., 2003). However, little is known about how symptoms cluster in breast cancer survivors after treatment ends, what the underlying mechanisms are,

and if effective interventions can favorably impact symptom clusters (Cleeland et al., 2003; Lee et al., 2004a).

Patients often experience an array of symptoms, making it clinically-relevant to assess and treat for clusters of symptoms rather than focusing on an individual symptom (Miaskowski et al., 2004). Reducing the overall symptom burden proactively is also more cost-effective. Although other mind–body interventions have been shown to reduce individual symptoms after breast cancer (Cimprich et al., 2005; Mishel et al., 2005; Scheier et al., 2005; Stanton et al., 2005), no studies were found that tested the effects of an intervention on clusters of symptoms during post-treatment survivorship. Mindfulness Based Stress Reduction (MBSR) is a clinical stress-reduction program that provides training to patients to promote stress reduction through 4 meditative practices and the use of the attitudinal foundations of mindfulness practices, including: non-judging, patience, the beginner's mind, trust, non-striving, acceptance, letting go, and compassion (Kabat-Zinn et al., 1985, 1992). MBSR has been shown in women with breast cancer to reduce individual symptoms of fatigue and mood disturbance (Carlson and Garland, 2005), and stress-related anxiety, depression, anger, and confusion (Speca et al., 2000). MBSR also improved sleep quality, but did not affect sleep efficiency (Shapiro et al., 2003). Preliminary studies of our team demonstrated that MBSR for breast cancer (BC) survivors is effective for reducing individual symptoms of depression, anxiety, fears of recurrence, and increasing some aspects of QOL (Lengacher et al., 2009, 2010).

In this analysis, we assessed both the prevalence and severity of individual symptoms and clusters of symptoms experienced by women up to 18 months after breast cancer treatment and tested the effect of MBSR on these symptoms. The aims of this study were to: (1) determine the prevalence and severity of post-treatment symptoms (individual and clusters); and (2) determine the effectiveness of MBSR(BC), compared to Usual Care (control), to reduce individual and clusters of symptoms. This pilot study assessing symptom clusters was part of a broader study exploring the effects of MBSR(BC) on biological outcomes and psychological characteristics of patients as they transitioned off cancer treatment (Lengacher et al., 2009).

Methods

Sample and setting

A two-armed randomized controlled design, with randomization stratified by stage of cancer (0, I, III, and III) and treatment received (radiation treatment only or radiation treatment and chemotherapy), was used to randomly assign enrolled participants to either an MBSR(BC) group or a wait-listed control group. The control regimen consisted of standard post-treatment clinic visits with their practitioners, and varied depending on the patients' treatment plan. Participants in the control group were asked not to use or practice meditation, yoga techniques, or MBSR throughout the study period, although actual compliance was not recorded. Upon completing the study, each control participant was provided with a brief overview of MBSR(BC), study materials including an MBSR(BC) manual and 4 CDs for practice, and was offered optional scheduled classes.

A total of 84 women were recruited from H. Lee Moffitt Cancer Center and Research Institute located in Tampa, Florida. Eligibility criteria for this sample included women age 21 or older with a previous diagnosis of stage 0, I, II, or III breast cancer and who had undergone surgery, received adjuvant radiation and/or chemotherapy and completed treatment within 18 months prior to study enrollment. Additionally, all subjects had to be able to read and speak English at the 8th grade level. Exclusion criteria included stage IV breast cancer, history of mastectomy, severe psychiatric diagnosis (e.g. bipolar disorder) and treatment for recurrent breast cancer. All subjects provided written informed consent, and the study protocol was approved by the Institutional Review Boards at the University of South Florida and at Moffitt Cancer Center in Tampa, FL.

Measures

Symptoms

Patient symptoms were measured by the M.D. Anderson Symptom Inventory (MDASI) (Cleeland et al., 2000) at baseline and within 2 weeks after the 6-week MBSR intervention. The MDASI measures the severity of symptoms and the degree that they may interfere with daily functioning. The MDASI has been validated across multiple cancer diagnoses and multiple populations (Chen & Lin, 2007; Ivanova et al., 2005; Kwon et al., 2006; Okuyama et al., 2003; Tseng et al., 2008; Wang et al., 2004, 2006b). The MDASI includes 13 core symptom severity items (i.e., pain, fatigue, sleep disturbance, drowsiness, lack of appetite, nausea, vomiting, shortness of breath, numbness, difficulty remembering, dry mouth, distress, and sadness) and 6 symptom interference items (i.e., general activity, mood, work (including work around the house) relations with other people, walking and enjoyment of life). The participant rated each symptom on a scale of 0 (symptom not present) to 10 (the symptom is as bad as I could imagine). Participants rated the degree of interference for 6 activities on a similar 0–10 scale (e.g., work, relationships) in the second part of the MDASI. Internal consistency for the symptom

severity and symptom interference ranged from .82 to .94 (Cleeland et al., 2000).

Demographics and medical history

A standard demographic data form and detailed clinical history form were completed by self-report at baseline.

Procedures

The principal investigator and research associates recruited participants from clinics who expressed an interest in the study; participants were invited to an orientation session where informed consent was obtained. Data on measures of presence of symptoms (MDASI), patient demographics, and clinical history were collected at baseline (1 week prior to the MBSR (BC) intervention) and within 2 weeks after the 6-week MBSR(BC) intervention. Participant randomization was done after baseline assessments were complete. Participants who were randomized to the MBSR(BC) group participated in the MBSR(BC) program the following week.

MBSR(BC)

The goal of MBSR training is to teach participants to become more aware of their thoughts and feelings through meditation practice and to pay attention and observe their responses during stressful situations (Kabat-Zinn et al., 1985). The MBSR(BC) program was condensed to a 6-week format from the original 8-week program developed by Kabat-Zinn and excluded the 1 day, 8-h silent retreat. The 6 weekly, MBSR(BC) program were 2-h sessions taught by a licensed clinical psychologist trained in MBSR and included all the original content of the 8-week program. In addition, the program included group support sessions focused on emotional/psychological responses (e.g., anxiety, depression and fear of recurrence) and physical symptoms (e.g., pain and sleep) that are common concerns to women with breast cancer.

MBSR(BC) included: (a) educational material related to relaxation, meditation, and the mind–body connection; (b) meditation practice in weekly group sessions and homework assignments; and (c) group discussion of barriers to the practice of meditation and application of mindfulness in daily situations; and (d) supportive interaction between group members. The formal meditative training consisted of 4 types of techniques (sitting and walking meditation, body scan, and gentle Hatha yoga) that focus attention on the breath (Kabat-Zinn et al., 1985). Informal mindfulness meditation was used to teach participants how to practice mindfulness in everyday life, and included being aware of pleasant and unpleasant events, routine activities, and everyday events.

Statistical analyses

The first aim of this study was to determine the individual symptoms and clusters of symptoms experienced by women who recently completed treatment for breast cancer. Descriptive statistics were used to measure the prevalence (percentages) and severity (means and standard deviations [SD]) of individual symptoms reported. A hierarchical cluster analysis (a common method used to study the MDASI) was used for the analysis of symptom clusters (Cleeland et al., 2000; Okuyama et al., 2003; Tseng et al., 2008; Wang et al., 2006b; Yamagishi et al., 2009). This cluster analysis used an average linkage approach between groups and the distances were calculated using squared Euclidean distances. The results from the MDASI cluster analysis are displayed as a dendrogram. Similar rankings appear closer to each other in the dendrogram, with the most similar symptoms having bars with shorter relative distances. Similar to Wang et al. (2008), symptom cluster scores were calculated by summing the responses of items within each of the three pre-treatment baseline clusters. Separate symptom cluster scores were calculated for the pre- and post-treatment MDASI responses.

The second aim examined the effectiveness of MBSR(BC), compared to a control group, on the individual MDASI items and clusters of physical and psychological symptoms. To minimize the potential for type 1 error as a result of multiple comparisons (13 symptoms, 6 interference items, and 3 clusters), the nominal alpha was set at .01 (compared to the conventional .05). Post-MBSR(BC) between-group comparisons were made using the Wilcoxon ranks sums test. A non-parametric approach was chosen because many MDASI items were positively skewed leading to high Anderson–Darling statistics (indicating non-normal distributions). Because a relatively conservative alpha level reduces the power to detect significant effects, the decision was made to additionally make within-groups comparisons (repeated measures). Given a sample size of 40 women per group, this decision reduced the detectable effect size from .8 to .6 (an improvement in power). SPSS version 17.0 was used to conduct all statistical calculations, including the cluster analyses.

Results

Participants characteristics

Details of the recruitment, including a flowchart of the allocation of participants and dropouts, have previously been described (Lengacher et al., 2009). Briefly, 82 of the 84 participants (97.6%) who enrolled in the study completed baseline and 6-week assessments. Participants were

randomly assigned to control (n = 43) or MBSR(BC) (n = 41) groups. The 2 groups were similar on demographic baseline characteristics, with the exception of a higher frequency of Black participants being assigned to the control group versus the MBSR(BC) group (18.6% versus 4.9%, $P = 0.05$). The mean age of study participants was 58 ± 9.4 years. Participants did not differ statistically on any cancer-related or treatment-related characteristics (Table 1). Additionally, they did not statistically differ on use of antidepressants, anxiolytics, or antihypertensives, which also may affect MDASI outcomes.

Baseline assessments occurred 1–63 weeks from cancer treatment completion (median 15 weeks) in the MBSR(BC) group and from 0 to 80 weeks (median 11 weeks) in the control group. Nine subjects in the MBSR(BC) group (22%) and 11 subjects in the control group (26%) had completed their cancer treatment less than 6 weeks before entering the study.

Aim 1: prevalence of individual and clusters of symptoms; severity and interference

Individual symptoms at baseline

Table 2 reports the prevalence and severity of MDASI symptoms for all women at baseline. Both the MBSR(BC) group and the control group had similar mean symptom severity and similar interference with daily activities prior to any intervention ($P > .07$ for each item). Fatigue was the most frequently reported symptom (85% of subjects) and was the most severe symptom in both groups (mean score of 3.6). Although the majority of participants reported experiencing many symptoms on the MDASI, symptom severity and degree of interference were fairly low across items. Prevalence indicates any symptom report scoring greater than 0 on the 0–10 scale.

Table 1 Participant breast cancer characteristics

Variable	Control n = 43	MBSR(BC) n = 41
Stage 0	9	5
Stage 1	19	26
Stage 2	12	7
Stage 3	3	3
Radiation only	26	25
Radiation and chemotherapy	17	16
Mean weeks since cancer treatment	17.56	20.07

Symptom clusters at baseline

Cluster analysis was first conducted separately based on time since cancer treatment completion. With minor exceptions, the clusters observed in the 2 groups were identical. To enhance the reliability of the cluster analysis, we combined all participants. The dendrogram (Fig. 1) and Table 3 illustrate 3 symptom clusters that emerged from the data: (1) a *gastrointestinal cluster* that included symptoms of nausea, vomiting, lack of appetite, dry mouth, shortness of breath and numbness; (2) a *cognitive/psychological cluster* that included symptoms of distress, sadness, remembering and pain; and (3) a *fatigue cluster* that included symptoms of fatigue, disturbed sleep and drowsiness.

Aim 2: changes in individual symptoms and clusters of symptoms after MBSR(BC)

Symptoms after participation in the MBSR(BC) program

Table 2 presents mean symptom and interference severity for control and MBSR(BC) groups both at baseline and 6-week post-assessment. *P* values for the within-groups comparisons also are presented. Following the program, participants in both groups tended to improve on MDASI symptoms when compared to baseline. In spite of this tendency for *all* participants to improve, at post-intervention, the MBSR(BC) group showed greater improvement across symptoms, and especially symptom interference items, compared to the control group. For the MBSR(BC) group, statistically-significant reductions ($P < .01$) were observed for the 2 most prevalent symptoms, fatigue, and disturbed sleep. Most notably, 5 of the 6 interference items also were reduced following MBSR(BC) (the exception being interference with walking). In contrast, 1 symptom (sadness) and 1 interference item (enjoyment of life) were statistically reduced in the control group. For the between-group comparisons, remarkably, 11 of 13 symptoms (the most prevalent eleven) and 5 of 6 interference items had lower means in the MBSR(BC) condition than the control condition. None of these differences reached the statistical significance criteria set for this study, but 2 symptoms (fatigue and drowsiness) and 3 interference items (Mood, Housework, and Relationships) were $P \leq .05$ (all in favor of MBSR(BC)). These trends should inform future larger studies with greater statistical power.

Changes in cluster score

With virtually all symptoms decreasing for both groups, when combined into cluster scores, significant decreases also were observed. Both MBSR(BC) and control groups

Table 2 Baseline and post-treatment symptoms and interference

	Baseline prevalence (%)	Severity $\bar{x}$(SD) by condition*						*P* (between-group post-assessment)
		Control			MBSR(BC)			
		Baseline	6-Week post-assessment	*P*	Baseline	6-Week post-assessment	*P*	
Symptom								
Fatigue	85	3.6(2.8)	3.0(2.6)	.11	3.6(2.7)	2.0(2.2)	.001	.05
Disturbed sleep	73	3.1(3.3)	2.1(2.9)	.01	3.2(3.0)	1.9(2.5)	.009	.98
Trouble remembering	73	2.9(2.7)	2.0(2.2)	.03	2.1(2.7)	1.3(1.9)	.05	.07
Drowsy	73	2.6(2.7)	1.9(2.0)	.13	2.2(2.1)	1.4(2.2)	.04	.05
Pain	60	1.8(2.2)	1.9(2.6)	.73	2.0(2.3)	1.4(1.8)	.04	.61
Distress	56	2.2(2.8)	1.4(2.2)	.01	1.7(2.5)	.82(1.5)	.02	.11
Numbness	52	1.6(2.5)	1.4(2.7)	.34	1.8(2.4)	1.1(1.8)	.07	.46
Sadness	51	2.1(2.8)	1.2(2.1)	.003	2.1(2.6)	.98(1.8)	.05	.35
Dry mouth	42	1.5(2.5)	1.1(2.1)	.08	1.0(1.6)	.68(1.6)	.12	.60
Shortness of breath	31	1.1(2.4)	.83(1.8)	.57	0.7(1.1)	.48(1.1)	.15	.21
Lack of appetite	26	1.0(2.1)	.73(1.6)	.11	0.5(1.2)	.25(.78)	.15	.06
Nausea	9	0.4(1.7)	.02(.15)	.11	0.2(0.6)	.05(.22)	.20	.53
Vomiting	1	0.1(0.5)	0.0(0.0)	.32	0.0(0.0)	.03(.16)	.32	.31
Interface								
Mood	57	2.4(3.2)	1.6(2.4)	.04	1.8(2.4)	.70(1.5)	.005	.04
General activity	56	2.1(3.2)	1.6(2.4)	.41	2.1(2.6)	.68(1.3)	.001	.12
Enjoyment of life	55	2.3(3.1)	1.3(2.1)	.008	1.6(2.2)	.63(1.6)	.003	.06
Housework	52	2.4(3.2)	1.5(2.3)	.03	2.0(2.7)	.57(1.3)	.002	.02
Walking	47	2.2(3.3)	1.0(1.8)	.02	1.5(2.6)	1.1(2.2)	.14	.46
Relationships	36	1.8(3.0)	.98(1.8)	.11	1.3(2.1)	.45(1.4)	.004	.05

* Symptom severity on a scale of 0–10, with 0 being no interference and 10 the "worst imaginable"

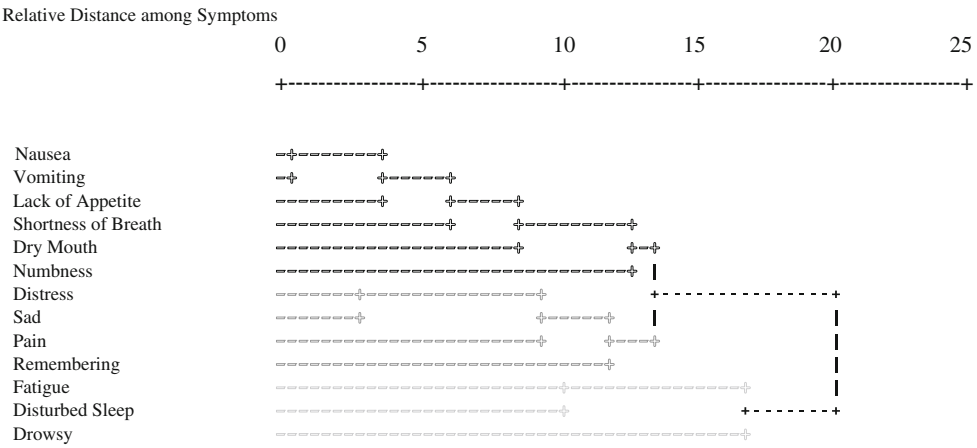

Fig. 1 This depiction of cluster analysis results presents symptom similarity. The figure is read from *left* to *right*. Connections between symptoms (*crosses*) occurring furthest to the left show the least distance (most similarity) between participant responses. This dendrogram is set up so the strongest connections are at the top of the figure and decrease lower on the figure

showed statistically-significant decreases in 2 out of 3 cluster scores ($P < .01$), with the third nearing significance ($P < .05$). Table 4 presents cluster score means (SDs) and within groups *P* values. Although reductions were observed across both conditions, again it is notable that all 3 cluster score means were lower following MBSR(BC) compared to control. None of these between-group differences were statistically-significant.

Discussion

This pilot study generated 3 preliminary conclusions that are clinically-relevant for women transitioning from breast cancer treatment to survivorship: (1) breast cancer survivors continue to experience multiple symptoms after completing treatment, although the severity of these symptoms may be less than when on treatment; (2)

Table 3 MDASI symptom clusters

Gastrointestinal	Cognitive/psychological cluster	Fatigue cluster
Nausea	Distress	Fatigue
Vomiting	Sadness	Disturbed sleep
Lack of appetite	Pain	Drowsy
Shortness of breath	Remembering	
Dry mouth		
Numbness		

symptoms clustered into a gastrointestinal symptom cluster, a cognitive-psychological cluster, and a fatigue symptom cluster; and (3) fatigue and the related symptom of sleep disturbance, along with most interference items were alleviated by MBSR(BC).

Consistent with existing symptom research on breast cancer survivors, the most frequently observed and most severe symptom was fatigue (Fu et al., 2009). Other prevalent symptoms included disturbed sleep, trouble remembering, drowsiness and pain. Even with the relative high frequency of some symptoms, overall symptom severity was low with the highest being fatigue, which had a mean of 3.6 on a 10-point scale. Severity for most symptoms averaged below 2. Other studies among breast cancer survivors show similar findings with fatigue and sleep disturbances among the most prevalent symptoms experienced by breast cancer survivors, with fatigue being particularly severe (Ashbury et al., 1998; Savard et al., 2005; Shimozuma et al., 1999) and associated with higher levels of sleep disturbance, pain, and depression (Bower et al., 2000).

In spite of relatively low severity, the symptoms clustered in ways that were largely comparable to clusters identified for patients on treatment (Chen & Lin, 2007; Chen & Tseng, 2005, 2006; Wang et al., 2006a; Yamagishi et al., 2009). Cognitive/psychological (Bender et al., 2005; Kim et al., 2008), gastrointestinal (Kim et al., 2008) and fatigue (Bower et al., 2000; Byar et al., 2006) (Gaston-Johansson et al., 1999; Liu et al., 2009) clusters previously have been identified in breast cancer populations.

It is notable that subtle differences were evident between this and previous studies. Chen and Tseng (2006) found that symptoms of pain, fatigue, disturbed sleep, lack of appetite, and drowsiness were related, while in our study, at least 1 of these symptoms was found in each of the 3 identified clusters. Yamagishi et al. (2009) and Wang et al. (2006a, b) observed 4 symptom clusters. Dissimilarities in these symptom cluster findings may be due to the fact that studies used heterogeneous cancer patient samples (Chen & Tseng, 2005, 2006; Yamagishi et al., 2009), lung cancer patients that may have unique symptoms (Wang et al., 2006a), and all patients in these studies were currently on treatment (Chen & Tseng, 2005, 2006; Wang et al., 2006a; Yamagishi et al., 2009).

With the exception of 3 symptoms (shortness of breath and numbness in the gastrointestinal cluster, and pain in the cognitive/psychological cluster), all symptoms clustered into categories that appeared to make intuitive sense. These few symptoms may have clustered in anomalous ways due to uniqueness of the sample. Cluster analysis is sample-dependent, especially with small sample sizes like the one used in this pilot study. Also, symptoms cluster based on responses relative to one another. Outcomes might vary with samples where symptoms are more severe as a whole or if individual symptoms increase relative to other symptoms, resulting in changes in the relationships among symptoms. Other factors that may explain the presence of unusual symptoms within clusters include selecting measurement tools that assess symptoms using single items. Cluster analysis may link dissimilar symptoms because no similar items are present in the measure.

Table 4 Pre- and post-test cluster scores

Mean cluster score (SD)*				
Control	Pre-test	Post-test	Possible range	*P***
Gastrointestinal cluster	5.71(7.23)	4.10(6.58)	0–60	.005
Cognitive/psychological cluster	8.93(8.10)	6.49(7.15)	0–40	.002
Fatigue cluster	9.31(6.91)	7.10(6.10)	0–30	.024
MBSR (BC)	Pre-test	Post-test	Possible range	*P***
Gastrointestinal cluster	4.23(4.61)	2.60(3.79)	0–60	.005
Cognitive/psychological cluster	7.48(8.48)	4.43(4.61)	0–40	.010
Fatigue cluster	8.93(6.45)	5.23(5.78)	0–30	.001

* Cluster scores were sums of the items comprising the cluster

** Pre-post comparisons were made using the Wilcoxon Signed Ranks Test

The biological mechanisms that tie symptom clusters together are largely unknown; however, some models have been proposed. Several factors suggest physiological or biological basis for certain symptom clusters. Pain, depression, and fatigue are the most common and distressing symptoms for advanced stage cancer patients; one study found that neuroendocrine levels or stress hormones predicted the shared variance among the symptom cluster of fatigue, pain, and depression (Thornton et al., 2010). Another study found that age and performance status influence the intensity of symptom clusters in women with breast cancer (Kim et al., 2009). Although the biological mechanism is unknown, Tsai et al. (2010) found that survival, functional performance, bone metastasis, and fluid accumulation were associated with clustering of symptoms.

Ultimately, the goal of studying symptom clusters (and their underlying mechanisms) is to reduce symptom severity and distress in ways that are more effective and efficient than treating isolated individual symptoms. In this study, symptom cluster reductions were observed in both MBSR(BC) and control conditions making it difficult to ascertain the benefit of MBSR(BC) with these symptom combinations. However, the results suggest that further investigation is warranted.

Participants who received MBSR(BC) showed improvement in fatigue and sleep disturbance and less of an interference with mood, general activity, enjoyment of life, relationships, and everyday functioning. The improvement in fatigue after MBSR is of particular interest because of the frequency and severity of fatigue in breast cancer survivors and its correlation with depression (Bower et al., 2000; Carpenter et al., 2004), pain (Bower et al., 2000), less sleep (Carpenter et al., 2004), and lower QOL (Baker et al., 2005). Several studies using MBSR have shown its efficacy in reducing fatigue among cancer outpatients (Carlson & Garland, 2005; Carlson et al., 2001), caregivers (Minor et al., 2006), and medical students (Rosenzweig et al., 2003). Despite reductions in fatigue and the related (clustered) symptom sleep disturbance in the control group, statistically-significant reductions were only observed in the MBSR(BC) group. These differences cannot be explained by comorbid conditions affecting fatigue, or the drugs used to treat them, because they did not differ between the groups.

Because the modest improvement in fatigue in response to MBSR(BC) is an important and clinically-relevant patient-reported outcome, future studies may want to use validated multi-item measures of fatigue, such as the Fatigue Symptom Inventory (FSI) (Hann et al., 2000), rather than the single item used here. A multi-item instrument may be a more reliable assessment of these effects.

The severity of relatively few symptoms were affected by MBSR(BC); however, nearly all of the interference items were reduced. Although not hypothesized a priori, a greater effect on the interference resulting from symptoms, rather than the symptoms themselves, makes sense. The MBSR(BC) used in this study taught participants to be aware of unpleasant events. Rather than trying to reduce these events, participants were instructed on techniques to reduce the impact of these events on QOL. A validated QOL measure was not used in this study, but interference items such as "enjoyment of life," "everyday activity," and "relationships" certainly are face valid measures of the construct. This pattern of results suggests that MBSR(BC) may have little influence on symptoms, but a substantial effect on symptom interference.

Limitations

Because many statistical comparisons were made between MBSR(BC) and control conditions, the nominal alpha in this study was reduced to minimize type I error. However, the consistent between-group trends for MBSR(BC) to improve several symptoms and interference domains raises the possibility that insufficient sample size did not allow for detection of additional significant differences (i.e., type 2 error). The effects of MBSR(BC) also may be underestimated in this study because the symptoms reported in both groups at baseline were generally low, indicating a potential floor effect with little room for improvement. Therefore, the possibility exists that this sample did not have sufficiently severe symptoms to test the full extent of the effects of MBSR(BC).

Conclusion

In conclusion, this study found 3 symptom clusters (gastrointestinal, cognitive/psychological and fatigue) and fatigue to be the most prevalent individual symptom in breast cancer survivors off treatment. The results suggest that MBSR(BC) modestly decreases fatigue and sleep disturbances, but has a greater effect on the degree to which symptoms interfere with many facets of life. Although these results are preliminary, MBSR intervention post-treatment may effectively reduce fatigue and related interference in QOL of breast cancer survivors.

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