A QUALITATIVE AND QUANTITATIVE STUDY EXAMINING EFFECTS OF MINDFULNESS-BASED STRESS REDUCTION (MBSR) ON PHYSICAL AND PSYCHOLOGICAL WELL-BEING AMONG BREAST CANCER SURVIVORS

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In Partial Fulfillment

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by

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The undersigned, appointed by the Dean of the Graduate School, have examined the dissertation entitled

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Presented by Yaowarat Matchim

A candidate for the degree of Doctor of Philosophy

And hereby certify that in their opinion it is worthy of acceptance.

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DEDICATION

I would like to dedicate my dissertation and my degree to my family in Thailand - - my mother, my uncle, and my sister who always support me. They are looking forward to hearing from me about my progress and my graduation. In addition, I would like to express my gratitude to my aunt who passed away with lung cancer. She was the person who made me change my area of interest from critical care to complementary and alternative medicine, in particularly, mindfulness meditation.

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In recognition of these accomplishments, I received the 2008 International Orem Society New Scholar Award from the IOS at the 10th World Congress, Canada. I was nominated for the Nursing Alumni Organization's PhD Student Award for Overall Excellence Sinclair School of Nursing, University of Missouri in 2008 and 2009; I received the PhD Student Award for Overall Excellence 2009 from Nursing Alumni Organization, Sinclair School of Nursing, University of Missouri. I was selected by the Sinclair School of Nursing to be included in the 2009 edition of Who's Who Among Students in American Universities & Colleges based upon outstanding academic

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My dissertation could not be completed without the full cooperation of 32 study participants, early-stage breast cancer survivors. Especially, the 15 participants in the intervention group through their participation and openness about their thoughts and perceptions in relation to mindfulness meditation practice allowed me to gain knowledge

and better understanding in the work and mechanisms of meditation, as well as possible application in clinics and communities.

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ABSTRACT

The study used a mixed-method, quasi-experimental, pre- and post-test control group design with qualitative approaches to examine effects of Mindfulness-Based Stress Reduction (MBSR) on physiological and psychological well-being among breast cancer survivors. The sample consisted of 32 participants, the intervention group (n = 15) and the control group (n = 17). The outcome variables including blood pressure (BP), heart rate (HR), respiratory rate (RR), salivary cortisol, mood disturbance, symptoms of stress, and mindfulness state were measured at baseline, immediately after the intervention completion, and one-month follow-up. The intervention group received the eight-week MBSR program. The control group received no intervention. ANOVA and ANCOVA were used to examine between-group differences on each of the seven variables. A two-factor ANOVA was used to examine the changes from baseline within-group on all of the seven outcome variables. Qualitative data were derived from in-depth interviews with fifteen participants in the intervention group, non-participant observation, and field notes, as well. Qualitative data were analyzed using editing style content analysis.

The results of quantitative analyses demonstrated that MBSR was associated with statistically significant improvement in physiological and psychological outcomes in early-stage breast cancer survivors, including increased mindfulness state and reduced high blood pressure, heart rate, and respiratory rate at the significance level of $p = .05$ to $p = .001$. Some outcome variables are effective at the intervention completion; some are effective at the follow-up measurement, whereas some variables were effective at both measurement time points. The effect of MBSR on reducing stress in this sample was statistically significant on the physiological outcome (morning cortisol) at the measurement immediately after the intervention completion, but this effect was not sustained at one-month follow-up. MBSR showed a trend toward improving psychological outcomes by reducing mood disturbance (POMS) in this sample, but the change did not reach statistical significance at $p = .05$.

Qualitative findings demonstrated that participants decided to participate in the MBSR study based on two main reasons: "*searching for ways of stress reduction*" and "*having previous knowledge about benefits of mindfulness meditation*." All participants reported favorable or pleasant experiences during the practice. These experiences were described as "*being really relaxed,*" "*having a sense of peace,*" and "*putting everything aside*." In addition to pleasant experiences, four participants reported some unpleasant experiences, including difficulty in doing some yoga positions, pain in certain positions, and difficulty in concentrating during sitting meditation. The changes resulting from implementing meditational techniques in their daily lives were reported as: "*reducing stress," "being more aware," "being more accepting," "being refreshed and having more energy,"* and *"having a whole life change."* Participants recommended that the

MBSR program should be provided for cancer patients, other groups of patients, and communities, as well. In addition, it was suggested that MBSR be integrated into the curricula for health professional students.

These findings suggested that MBSR showed promise in promoting positive physiological and psychological outcomes for early-stage breast cancer survivors and other cancers, as well.

CHAPTER ONE

BACKGROUND AND SIGNIFICANCE

Introduction

A comprehensive review of literature indicated that a Mindfulness-Based Stress Reduction (MBSR) program may be a useful self-care practice for promoting physiological and psychological health and well-being for people over a broad continuum of care (Grossman, Niemann, Schmidt, & Walach, 2004). Quantitative studies conducted with several groups, such as patients with chronic pain, anxiety, psychological disorders, and cancer, have confirmed this outcome (e.g. Carlson & Garland, 2005; Kabat-Zinn, 1987; Kabat-Zinn et al., 1992; Tacon, Caldera, & Ronaghan, 2004). In studies among cancer patients, the majority of previous studies lacked a comparison group and studied samples that included heterogeneous types and stages of cancer. Thus, these studies may have limitations in terms of generalization to breast cancer patients, a cohort of cancer patients who are at high risk for reporting physical and psychological problems more often than other cancer (Tacon et al., 2004). The present study intends to close this gap by using mixed methods to examine the effects of MBSR on physical and psychological health and well-being among early stage (stages 0 to II) breast cancer survivors. Heart rate, respiratory rate, blood pressure, salivary cortisol, stress, mood disturbance, and mindful states were measured quantitatively at baseline, immediately after intervention completion, and at one month after intervention completion. A qualitative approach was

used to explore participants' experience in practicing mindfulness meditation. The findings of this study may be useful for oncology health care providers and other breast cancer survivors, as well. Using quasi-experimental comparison group-design, the quantitative findings of this study may be more appropriate for generalizing for early-stage breast cancer patients than past studies. In addition, qualitative information may help provide knowledge and understanding in the experience of breast cancer patients practicing mindfulness meditation, such as the ways they learned to deal with stress and difficult situations in their daily lives, as well as resulting change in their thoughts, perceptions, and feelings.

Breast cancer and related distress

Breast cancer is the most common type of cancer in women and it has been indicated that the diagnosis of cancer elicits greater distress than any other diagnosis, regardless of the prognosis (Tacon, Caldera, & Ronaghan, 2005). In 2009, it is estimated that 192,370 women were diagnosed with and 40,170 women died of breast cancer (National Cancer Institute, 2009). 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). There are many potential sources of distress occurring after women have a diagnosis of breast cancer, 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, & Speca, 2007). The distress decreases breast cancer survivors' well-being and quality of life. It has been reported that 22% to 50% of breast cancer survivors meet the

criteria for a psychiatric diagnosis of depression, 3% to 19% meet the criteria for post-traumatic stress disorder, and 33% meet the criteria for acute stress disorder (Classen et al., 2001). 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, a feeling of loneliness after women were diagnosed with breast cancer was reported, associated with difficulty in maintaining established relationships with others (Wolberg, Romsaas, Tanner, & Malec, 1989). Although distress symptoms in some breast cancer survivors might not be as frequent or intense as full post-traumatic stress disorder (PTSD), these symptoms can still seriously impair the person's quality of life and well-being (Amir & Ramati, 2002). Koopman et al. (2002) reported traumatic stress symptoms in women with breast cancer was greater in frequency among those who were younger, who received post-surgical cancer treatment, who were low in emotional self-efficacy, and whose lives were most affected by having cancer.

Mindfulness-Based Stress Reduction (MBSR)

Mindfulness-Based Stress Reduction (MBSR), a form of mindfulness training, was developed in 1979 by Jon Kabat-Zinn (Kabat-Zinn, 1982), and has been used as a clinical intervention for a variety of problematic conditions (Lau et al., 2006). This structured program lasts for 8 to 10 weeks for a group of up to 30 participants who meet weekly for 2-2.5 hours for instruction and practice in mindfulness meditation skills, together with discussion of stress, coping, and homework assignments. Participants are instructed to practice these skills outside of the group meetings for at least 45 minutes per

day, six days per week (Baer, 2003). An all-day (7-to-8-hours) intensive mindfulness session usually is held around the sixth week.

A review of literature regarding effects of mindfulness meditation on health revealed positive outcomes on numerous aspects in a variety of samples in diverse settings (Grossman et al., 2004). A number of quantitative studies reported significant effects of mindfulness meditation such as: (a) reducing generalized anxiety and panic disorders (e.g. Kabat-Zinn et al., 1992; Miller, Fletcher, & Kabat-Zinn, 1995); (b) reducing mood disturbance and stress levels, anxiety, anger, and confusion (e.g. Speca, Carlson, Goodey, & Angen, 2000; Tacon et al., 2004); (c) promoting positive effect on psychological symptoms, empathy ratings, and spiritual experiences (e.g. Shapiro, Bootzin, Figueredo, Lopez, & Schwartz, 2003; Shapiro, Schwartz, & Bonner, 1998); and (d) reducing pain level (e.g. Kabat-Zinn, 1982; Kabat-Zinn, Lipworth, Burney, & Sellers, 1986; Morone, Greco, & Weiner, 2008). The practice of mindfulness meditation has also been associated with physical benefits, such as decreased heart rate (Carlson, Speca, Faris, & Patel, 2007), slowed respiration (Cysarz & Bussing, 2005), lowered blood pressure (Carlson et al., 2007; Chaiopanont, 2008), lowered lipid levels (Schneider et al., 1998), decreased levels of circulating stress hormones (Carlson et al., 2007; Tang et al., 2007) and enhanced immune function (Carlson et al., 2007).

Although the reviewed studies revealed significant positive outcomes of mindfulness meditation in several samples with various problematic conditions in clinical settings, the majority of studies were one-group pre-post-test design, and were conducted with heterogeneous types and stages of disease.

Problem statement

Existing quantitative studies have limitations in terms of generalization for the breast cancer population, as the majority of studies lacked a comparison group, and samples included participants with heterogeneous types and stages of cancer. A similar limitation is found in the qualitative study (Mackenzie et al., 2007) which was conducted with heterogeneous types and stages of cancer, including predominantly breast and prostate cancer patients. Therefore, there is a need to examine the effect of MBSR on physiological and psychological outcomes among breast cancer patients, as well as to explore experiences in practicing mindfulness meditation in this group. The present study intends to close this gap as it is a quasi-experimental, pre-post-test, control group design with a qualitative component. In addition, the study was conducted with a single diagnostic group early-stage (stage 0 to II) breast cancer survivors.

Purpose

With the intention to close the gaps noted above, the primary purpose of the study used a quantitative methodology to examine the effects of a Mindfulness-Based Stress Reduction (MBSR) program on the physiological and psychological outcomes among early-stage (stage 0 to II) breast cancer patients immediately following the MBSR program completion and at one month after the program. The physiological variables focus on heart rate (HR), respiratory rate (RR), blood pressure (BP), and salivary cortisol. The psychological variables include self-reported stress levels, mood disturbance, and mindfulness state. The secondary purpose of this study used a qualitative approach to explore the experience of practicing mindfulness meditation among breast cancer patients.

Research Questions

1. Is there a difference in physiological and psychological outcomes between breast cancer survivors who participate in the MBSR program and those in the control group at baseline (T1)?

2. Is there a difference in physiological and psychological outcomes between breast cancer survivors who participate in the MBSR program and those in the control group at:

    2a: the measurement immediately after the MBSR completion (T2)?

    2b: at one-month follow-up (T3)?

3. Is there a difference in physiological and psychological outcomes within breast cancer survivors who participate in the MBSR program at:

    3a: the measurement immediately after the MBSR completion (T2), as compared to baseline (T1)?

    3b: one-month follow-up (T3), as compared to baseline (T1)?

4. Is there a difference in physiological and psychological outcomes within breast cancer survivors who are in the control group at:

    4a: the measurement at T2, as compared to baseline (T1)?

    4b: the measurement at T3, as compared to baseline (T1)?

5. What did the breast cancer survivors find helpful in practicing mindfulness meditation?

Hypotheses

H_1: Breast cancer survivors who participate in the MBSR program and those in the control group are not significantly different in the variables of interest (systolic blood pressure, diastolic blood pressure, heart rate, respiratory rate, morning cortisol, afternoon cortisol, mood disturbance, symptoms of stress, and mindfulness state) at the baseline measurement.

H_2: Breast cancer survivors who participate in the MBSR program will have a statistically significant improvement in physiological and psychological outcomes when compared to those in the control group:

H_{2a}: at the measurement immediately after the MBSR completion (T2).

H_{2b}: at one-month follow-up (T3).

H_3: Breast cancer survivors who participate in the MBSR program will have a statistically significant improvement in their physiological and psychological outcomes:

H_{3a}: at the measurement immediately after the MBSR completion (T2), as compared to baseline (T1).

H_{3b}: at one-month follow-up (T3), as compared to baseline (T1).

H_4: Breast cancer survivors who are in the control group will <u>not</u> have a statistically significant improvement in their physiological and psychological outcomes:

H_{4a}: at the measurement at T2, as compared to baseline (T1).

H_{4b}: at the measurement at T3, as compared to baseline (T1).

Significance of the Study

Breast cancer is the most common type of cancer in women, and breast cancer survivors are at high risk for physical and psychological problems during diagnosis, treatment, and survivorship. The practice of MBSR has shown positive improvement in physiological and psychological outcomes in several groups with a variety of problematic conditions such as pain, stress, anxiety, depression, and disordered eating. The physical benefits reported included lowered heart rate, slowed respiration, lowered blood pressure, lowered lipid levels, decreased levels of circulating stress hormones, and enhanced immune function. This information indicates that the MBSR may be a useful intervention for breast cancer survivors to promote physiological and psychological well-being.

However, the majority of previous studies that examined the effect of MBSR among cancer patients did not have comparison groups and studied subjects that included heterogeneous types and stages of cancer, indicating that these studies may have limitations in terms of generalization for breast cancer patients. In addition, only one published qualitative study exploring the experience of cancer patients practicing mindfulness meditation was found (Mackenzie et al., 2007).

Thus, to close the gaps noted above, there is a need to examine the effect of MBSR among breast cancer survivors. The present study will use mixed methods to examine the effects of MBSR on physiological and psychological health and well-being among early-stage (stage 0 to II) breast cancer survivors. Findings from this study may be generalized to early-stage breast cancer patients. In addition, they may have important implications for survivors diagnosed with other cancers in a variety of settings, as well.

Furthermore, this study provides additional knowledge and methods for oncology nurses and others working in this area to implement the MBSR program, as complementary and alternative medicine, for clients in oncology settings. This knowledge and method may be applicable for cancer survivors as well as others in the community.

Definition

Mindfulness meditation is a practice of training concentrated attention by focusing upon a sound, object, visualization, breath, movement, or attention itself in order to increase awareness of the present moment, reduce stress, promote relaxation, and enhance personal and spiritual growth. Mindfulness meditation originated in Eastern meditation practice; it is the method the Buddha taught as part of the means of ending suffering (Bonadonna, 2003). Through practicing meditation, one can focus on the present, not think about the past, or worry about the future: at this point, one can end his/ her suffering. In order to build and maintain mindfulness, one is required to practice these specific skills over and over again. Thus, 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).

Mindfulness meditation has been practiced in various forms in many cultures. One example has been the Buddhist practice based on maintaining continuous awareness of: (1) the body (e.g. the breath, posture, bodily sensations, etc); (2) feelings (whether pleasant, unpleasant, or neutral); (3) states of mind (e.g. depressed, anxious, or angry); and (4) the mental contents (the objects or thoughts occupying the mind at a given moment) (Khong, 2007).

Kabat-Zinn, a scientist, writer, and famous meditation teacher who developed the Mindfulness-Based Stress Reduction (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" (Kabat-Zinn, 1994, p. 4). He also stated that the power of mindfulness lies in its practice and its applications. Kabat-Zinn introduced the MBSR program as an intervention needing to be free of the cultural, religious, and ideological factors associated with the Buddhist origins of mindfulness, and to offer an environment within which to experiment with a range of novel and potentially effective methods for facing, exploring, and relieving suffering at the levels of both body and mind, and understanding the potential power inherent in the mind/body connection itself in doing so (Kabat-Zinn, 2003).

To be mindful means to be present and clearly observe sensations, emotions, and thinking; to be alert and recognize distractions from experiencing the present moment; and to be willing to let the distractions go. Training the mind to return to the present moment of the breath, emotion, or body sensation over and over again is the work of mindfulness meditation (Goldstein & Kornfield, 1987; Humber, 1984).

Types of Meditational Techniques

There is a wide variety of different meditational techniques associated with different traditions (Valentine & Sweet, 1999); these techniques share many common outcomes, such as equanimity, detachment, and clearer sensory perceptions (Bonadonna, 2003). There is general agreement that these techniques all involve alterations in attention, which may lead to modifications in the perception of oneself in relation to the

world. Based on the ways of paying attention, there are two broad types of meditational techniques that are clearly different: concentrative meditation and mindfulness meditation (Brown, 1977). These two types share the intentional training of individuals' attention and concentration. For the first basic type, *concentrative meditation*, one can focus any of the senses on a vary specific object or single-point "one-pointedness" or "zoom lens attention" (Delmonte, 1989, p. 45). With this practice, one learns how to cultivate one point of attention by focusing on a mantra, sound, visual image, object, or koan. For example, in transcendental meditation (TM), practitioners are taught to repeat a sound or phrase to focus and concentrate the mind and cut through discursive thinking.

The second basic type is *mindfulness meditation* which is 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). That is, attention is receptive to the whole field of awareness and remains in an open state so that it can be directed 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 (such as a breathing process, a sound, a mantra koan or riddle evoking questions, a visualization, etc.), and consciously scanning 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 it is present in the realm of consciousness.

In the practice of mindfulness meditation, no thought, image, or sensation is considered as an intrusion. The extension of awareness to a variety of events constitutes mindfulness. The emphasis of this practice is maintaining a detached, non-interpretative,

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). It is a process of paying attention on purpose to what is happening in the present moment, with no other goals. It is about being open to, curious about, and aware of one's own experience in the moment, not making judgments, developing plans, or strategizing (Ott, 2004). Phenomena that enter the individual's awareness during mindfulness practice, such as perception, cognitions, emotions, or sensation, are observed carefully but are not evaluated as good or bad, true or false, healthy or sick, or important or trivial (Baer, 2003).

In conclusion, these two basic types of meditation practice, concentrative meditation and mindfulness meditation, are different in terms of which extraneous stimuli are considered as distracters in concentrative meditation. In mindfulness meditation, no stimuli are extraneous because attention is open to the entire field of experience.

There have been attempts to examine the effect of practicing concentrative meditation and mindfulness meditation. Valentine and Sweet (1999) conducted a study to compare the performance of concentrative and mindfulness meditators on a task of sustained attention, and in particular to examine expectancy effects, which might help elucidate the attentional mechanisms developed in these two types of meditation. Participants were recruited from a Buddhist meditation center which employed these two types of meditation practice: concentrative meditation and mindfulness meditation. Participants (N = 19, mean age 32.9 years) who practiced each type of meditation were included in the study; the others who practiced both types of meditation were excluded.

The control group consisted of 24 second-year advanced-level students at a college of higher education (mean age 22 years). Wilkins' Counting Test, a measure of sustained focused attention, was used to measure participants' sustained attention. The results indicated that both groups of meditators, concentrative and mindfulness meditation, demonstrated superior performance on the test of sustained attention in comparison with controls, and long-term meditators were superior to short-term meditators. Participants who practiced mindfulness meditation showed superior performance in comparison with those who practiced concentrative meditation when the stimulus was unexpected. There was no difference between the two types of meditators when the stimulus was expected. These findings suggest that mindfulness meditators may deal with unexpected situations better than concentrative meditators.

Mindfulness Meditation used as Intervention in Clinical Studies

Although mindfulness meditation has its origins in Buddhism, it is not a religious practice. It can be learned and practiced regardless of religious affiliation. At present, several meditation programs, such as Mindfulness-Based Stress Reduction (MBSR), Mindfulness-Based Cognitive Therapy (MBCT), Dialectical Behavior Therapy (DBT), Mindfulness-Based Art Therapy (MBAT), and Acceptance and Commitment Therapy (ACT), are developed to be appropriate for particular groups of patients. In the next section, the review will focus on MBSR, the program which was most frequently used in clinical studies and which will be used in the present study.

Mindfulness-Based Stress Reduction (MBSR)

MBSR is the most commonly-used mindfulness-inspired therapy (Baer, 2003). The MBSR program was developed by Jon Kabat-Zinn, a scientist, writer, and meditation teacher at the University of Massachusetts Medical Center in 1979 (Kabat-Zinn, 1982). MBSR is a specific, highly-structured psycho-educational and skill-based therapy intervention that combines mindfulness meditation with hatha yoga exercises 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, or neutral feeling tone; bodily sensation; thoughts, etc.). When emotions, sensations, or cognitions arise, they 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 briefly noted, and then attention is returned to the object of focus (e.g. the breath). In conclusion, participants are instructed 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). Proulx (2003) stated that MBSR is not a "technique" for stress reduction and pain control, but rather a way of being or life, to be practiced independent of illness stage.

CHAPTER TWO

REVIEW OF LITERATURE

Review Studies of MBSR among Breast Cancer Patients

Articles published from 1982 – 2009 were retrieved using CINAHL, Ovid, PubMed, and Scopus (n = 16). Searches used combinations of these key words: MBSR, mindfulness-based stress reduction, cancer patients, and breast cancer. The search resulted in 26 articles which were narrowed down to 16 articles 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-post-test design and examined the effect of MBSR on psychological outcomes. Overall, they had large effect size on perceived stress and state anxiety and medium effect size on symptoms of stress and mood disturbance. Four studies measured biological outcomes and had small effect sizes, except cytokine production which showed a large effect size at 6-and 12-month follow-up. Summary tables of studies of MBSR among breast cancer patients are attached in appendix A.

Studies of MBSR with Breast Cancer Patients

Seven studies examined effects of MBSR with breast cancer patients alone (Dobkin, 2008; Hebert et al., 2001; Lengacher et al., 2009; Shapiro et al., 2003; Tacon et al., 2004; Tacon et al., 2005; Witek-Janusek et al., 2008). One of these studies (Dobkin, 2008) used a mixed-method, quantitative and qualitative design with thirteen breast

cancer patients. Two studies used one-group pre- and post-test design (Tacon et al., 2004; Tacon et al., 2005). Three studies used a randomized controlled trial (Hebert et al., 2001; Lengacher et al., 2009; Shapiro et al., 2003). One study (Witek-Janusek et al., 2008) used a non-randomized controlled trial with three-group comparison including MBSR, non-MBSR, and healthy women. Sample sizes of these six studies ranged from 13 to 172 subjects. The majority of studied variables focused on psychological aspects such as mood disturbance, depression, anxiety, symptoms of stress, and quality of life. One study (Witek-Janusek et al., 2008) also measured physiological variables including mononuclear cell, natural killer cell, cytokine, and plasma cortisol at pre-mid-post MBSR, and at one-month follow-up. Six studies were conducted in the US; one study was conducted in Canada (Dobkin, 2008).

Shapiro et al. (2003) conducted a randomized, controlled trial examining effect of six-week MBSR and free choice (N = 31: 32) on sleep quality among survivors with stage II breast cancer. Mood disturbance, depression, worry, anxiety, functional assessment of cancer treatment, sense of control, coherence and sleep efficacy were measured at pre-and post-intervention. Findings showed MBSR and the free choice control condition produced significant improvement in daily diary sleep quality measures, though neither showed significant improvement on sleep-efficiency. Participants in the MBSR group who reported greater mindfulness practice improved significantly more on the sleep quality measure most strongly associated with distress.

Tacon et al. (2004) examined effect of MBSR with 27 breast cancer survivors. Stress, anxiety, mental adjustment to cancer, and health locus of control were assessed at pre-and post-intervention. This study reported significant decreases in pre-to-post stress

and state anxiety levels; also reported were significant and beneficial changes for mental adjustment to cancer and health locus of control scores following the MBSR intervention.

Tacon et al. (2005) measured anxiety, coping style, and mental adjustment to cancer with 30 breast cancer survivors at pre-and post-MBSR intervention. Findings showed anxiety scores decreased significantly after the intervention (t= 5.74, $p < .001$). Three scales measured coping styles: reflective coping, reactive coping, and suppressive coping. Two scales, reactive coping and suppressive coping, decreased significantly after the intervention ($p < .001$ and $p < .05$ respectively). Four scales measured mental adjustment: helpless hopelessness, anxious preoccupation, fighting spirit, and fatalism stoic. Two scales (helpless hopelessness and anxious preoccupation) decreased significantly after the intervention ($p < .01$).

Lengacher et al. (2009) conducted a randomized, control trial examining effects of 6-week MBSR and usual care (N = 41:43) among women with breast cancer. Depression, anxiety, perceived stress, fear of recurrence, optimism, and social support were measured at pre-and post-intervention. Findings showed participants receiving MBSR had significantly lower ($p < .05$) adjusted mean levels of depression, anxiety, and fear of recurrence at six weeks, along with higher energy, physical functioning, and physical role functioning. Participants more compliant with MBSR tended to experience greater improvement in measures of energy and physical functioning.

Witek-Janusek et al. (2008) conducted a non-randomized controlled design with 3-group comparison (MBSR/non-MBSR/cancer-free, N = 38/28/30). Breast cancer survivors self-selected to either the MBSR or non-MBSR. Immune function, quality of life, coping style, and plasma cortisol were measured at pre-mid-post MBSR and at

one-month follow-up. At the first measurement, findings showed, reductions in peripheral blood mononuclear cell NK cell activity (NKCA) and IFN-c production with increases in IL-4, IL-6, and IL-10 production and plasma cortisol levels for both the MBSR and Non-MBSR groups. Over time, participants in the MBSR group re-established their NKCA and cytokine production levels. In contrast, participants in the non-MBSR group exhibited continued reductions in NKCA and IFN-c production with increased IL-4, IL-6, and IL-10 production. Moreover, participants in the MBSR program had reduced cortisol levels, improved QOL, and increased coping effectiveness compared to the non-MBSR group.

Dobkin (2008) conducted a mixed-method study using quantitative and qualitative approaches examining effects of MBSR with thirteen breast cancer survivors. Depression, medical symptoms, stress, sense of coherence, and mindful attention awareness were measured at pre-and post-intervention. Findings showed that participants increased in the use of palliative coping (ES = - 0.46) and mindfulness (ES = - 0.52), $p < .095$, and decreased in perceived stress (ES = 1.17) and medical symptoms (ES = 0.73). Four themes were reported for the usefulness of MBSR: acceptance, regaining and sustaining mindful control, taking responsibility for what could change, and spirit of openness and connectedness.

Hebert et al. (2001) conducted a randomized-clinical trial with a three-group comparison to examine effect of the interventions on diet and body mass in women with breast cancer. Survivors with stage I or II breast cancer (N = 172) were randomized to one of three groups: 15-week dietitian-led nutrition (NEP, n = 50); a Mindfulness-Based Stress Reduction clinic program (SRC, n = 51); or usual support care (UC, n = 56).

Primary outcome measures included dietary fat, complex carbohydrates, fiber, body mass, self-esteem, anxiety, distress, and depression. The measurements were assessed at pre-intervention, immediately post-intervention, four months later, and twelve months later. Results showed that women who participated in the NEP program experienced a large reduction in fat consumption (5.8% of energy as fat) at four months and much of this reduction was present at one year (4.1% of energy) (both $p < .0002$), whereas no change was found in either SRC or UC group. A 1.3-kilogram reduction in body mass was evident at four months in the NEP group ($p < .003$), whereas no charge was found in either SRC or UC group. In addition, self-esteem improvement of women in the NEP group was associated with decreased fat intake ($b = - 0.29$, $p < .001$). Interestingly, psychological variables were measured, but the findings were not reported in this article.

Studies of MBSR with Heterogeneous Types of Cancer in which the Predominant Cancer was Breast Cancer

Nine studies examined effects of MBSR among cancer patients in which the predominant cancer was breast cancer. Seven of nine studies were one-group pre-post-test design (Brown & Ryan, 2003; Carlson & Garland, 2005; Carlson et al., 2007; Carlson, Speca, Patel, & Goodey, 2003; Carlson, Speca, Patel, & Goodey, 2004; Carlson, Ursuliak, Goodey, Angen, & Speca, 2001; Kieviet-Stijnen, Visser, Garssen, & Hudig, 2008). Sample sizes of the one-group pre-post-test design ranged from 41 to 89. One study was a non-randomized comparison (N=104) (Garland, Carlson, Cook, Lansdell, & Speca, 2007). Only one study was a randomized, wait-list controlled clinical trial (N= 90) (Speca et al., 2000). Studied variables focused on psychological outcomes such as stress, mood disturbance, quality of life, etc. Three of nine studies also measured physiological

variables including salivary cortisol, endocrine, immune, cell count, melatonin, dehydroepiandrosterone-sulfate (DHEAS), and autonomic parameters (Carlson et al., 2007; Carlson et al., 2003; Carlson et al., 2004). Most importantly, these three studies were conducted with the same samples (49 breast and 10 prostate cancer patients); some studied variables were presented as a unique variable in each study. Seven of nine studies were conducted in Canada; one study was conducted in Netherlands (Kieviet-Stijnen et al., 2008); one study was conducted in the US (Brown & Ryan, 2003). Three studies (Carlson et al., 2007; Carlson et al., 2001; Kieviet-Stijnen et al., 2008) conducted follow-up measurements at six months and one year.

Carlson et al. (2001) examined effects of MBSR among 89 participants with various types and stages of cancer. Mood disturbance and stress were measured at pre-post-intervention and at six-month follow-up. Findings showed scores of mood disturbance and stress levels decreased significantly after the intervention. These improvements were maintained at the six-month follow-up. More advanced stages of cancer were associated with less initial mood disturbance, while more home practice and higher initial scores of mood disturbance predicted improvement on the mood disturbance scores.

Carlson et al. (2003) conducted a one-group pre-post-test study examining effects of MBSR among 49 breast and 10 prostate cancer patients. Quality of life, mood disturbance, stress, lymphocyte counts, and cytokine production were measured at pre and post-intervention. Significant improvements were reported in overall quality of life, symptoms of stress, and sleep quality. No significant changes were found in the overall number of lymphocytes or cell subsets; T cell production of IL-4 increased and IFN-

decreased, as did NK cell production of IL-10 decreased. These results indicated a shift in immune profile from one associated with depressive symptoms to a more normal profile.

Carlson et al. (2004) examined effects of MBSR with 49 breast and 10 prostate cancer patients. Quality of life, mood disturbance, stress, salivary cortisol, dehydroepiandrosterone-sulfate (DHEAS), and melatonin were assessed at pre-and post-intervention. At each measurement time point, salivary cortisol was collected three times per day: 8 AM, 2 PM and 8 PM. Findings showed significant improvements in overall quality of life, symptoms of stress, and sleep quality with MBSR practice, but these improvements were not significantly correlated with the degree of program attendance or minutes of home practice. Improvements in quality of life were associated with decreases in afternoon cortisol levels, but not with morning or evening levels. Changes in stress symptoms or mood were not related to changes in hormone levels. Approximately 40% of the sample demonstrated abnormal cortisol secretion patterns both pre- and post-intervention, but within that group patterns shifted from "inverted-V-shaped" patterns towards more "V-shaped" patterns of secretion.

Carlson et al. (2007) conducted a six-month and twelve-month follow-up examining effects of MBSR with 49 breast and 10 prostate cancer patients (extended study of Carlson et al., 2003, 2004). Quality of life, symptoms of stress, mood disturbance, endocrine profile, immune function, autonomic parameters, blood pressure, heart rate, and salivary cortisol were assessed. This study reported significant improvements in overall symptoms of stress which were maintained over the follow-up period. Cortisol levels decreased systematically over the course of the follow-up. Immune patterns over the year supported a continued reduction in Th1 (pro-inflammatory)

cytokines. Systolic blood pressure (SBP) decreased from pre- to post-intervention and heart rate (HR) was positively associated with self-reported symptoms of stress.

Carlson and Garland (2005) conducted a one-group pre-post study with 63 cancer patients; the majority of the sample were breast cancer patients (59%). Sleep quality, mood disturbance, and symptoms of stress were assessed at pre-and post-intervention. Findings showed overall sleep disturbance was significantly reduced ($p < .001$) and participants reported that their sleep quality had improved ($p < .001$). There was also a significant reduction in stress ($p < .001$), mood disturbance ($p = .001$), and fatigue ($p < .001$).

Kieviet-Stijnen et al. (2008) examined effects of MBSR with 47 cancer patients in the Netherlands. The intervention also emphasized a three-minute breathing exercise. Quality of life, physical symptoms, mood disturbance, joy in life, social desirability, and satisfaction were assessed. Results showed a better quality of life, more joy in life, less tension, and fewer physical symptoms. These effects appeared even stronger at follow-up. A year after the training, a decrease was also found in depression, anger, vigor and total mood disturbance. Effect sizes varied between 0.28 and 0.60.

Brown and Ryan (2003) conducted a series of studies in the development of the Mindful Attention Awareness Scale (MAAS); one study was implemented with 32 early-stage breast and 9 prostate cancer patients. Quality of life, mood disturbance (POMS), symptoms of stress (SOSI), and mindful attention were assessed at pre- and post-intervention. Findings showed that SOSI scores dropped significantly over the intervention period, $t(40) = 3.27$, ($p < .01$). Neither samplewide MAAS nor POMS scores showed a significant change. The increase of MAAS from pre- to post-intervention was

found be significantly predictive of the decreased scores of the POMS ($p < .01$) and the SOSI ($p < .01$). These relations between the MAAS and the outcomes were found after controlling for the influences of fatigue and pain.

Garland et al. (2007) conducted a non-randomized comparison study examining effects of MBSR and a creative art (HA) program (MBSR: HA, n = 60:44) with cancer patients; the majority of the sample were breast cancer patients. The development of post-traumatic growth, spirituality, stress, and mood disturbance were assessed at pre- and post-intervention. Findings showed that participants in both groups improved significantly over time on overall post-traumatic growth ($p < 0.015$). Participants in the MBSR group improved on measures of spirituality more than those in the HA group ($p < 0.029$). Participants in the MBSR group also showed more improvement than those in HA on measures of anxiety (POMS, $p < 0.038$), anger (POMS, $p < 0.004$), overall stress symptoms (SOSI, $p < 0.041$), and mood disturbance (POMS, $p < 0.023$). Several main effects of time were also observed in both groups.

Speca et al. (2000) conducted a randomized, wait-list controlled clinical trial examining effects of MBSR with 90 cancer patients (MBSR: wait-list, n = 53, 37). The majority of the sample were breast cancer patients. Mood disturbance and symptoms of stress were assessed at pre-and post-intervention. Findings showed patients in the treatment group had significantly lower scores on Total Mood Disturbance and subscales of Depression, Anxiety, Anger, and Confusion and more Vigor than control subjects. The treatment group 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. Overall reduction in Total Mood Disturbance was 65%, with a 31% reduction in Symptoms of Stress.

Findings from these reviewed studies indicated that MBSR is effective in decreasing stress, distress, state anxiety, and mood disturbance, and promoting sleep quality and quality of life for breast cancer survivors. These effects were maintained at 6 months and one year follow-up. The MBSR also showed effects in improving immune function and decreasing blood pressure in these samples. However, the effect of MBSR on biological outcomes was drawn based on only a few studies with one-group pre-post test design.

Effect Sizes

Most studies examined the effect of MBSR on psychological outcomes with a one-group pre-post-test design. Twelve of sixteen studies reported data for calculating effect size. For studies of one-group pre-post-test design, effect sizes were calculated by dividing the difference in mean scores between pre- and post-intervention with the pooled standard deviation (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 post-intervention between the two groups with the pooled standard deviation (SD) of the two groups. The calculation of effect sizes used the formulas described by Rosenthal (1991). When means and standard deviation were not reported, effect sizes were calculated from F values, such as the biological outcomes in the study of Witek-Janusek et al. (2008). Cohen (1992) suggested that effect sizes of .20 are small, .50 are medium, and .80 are large. Studies of MBSR with small sample sizes tend to have small effect sizes, as judged by Cohen (1992). Three studies that measured state anxiety and perceived stress (Dobkin,

2008; Tacon et al., 2004; Tacon et al., 2005) reported large effect sizes (>1.0). These effect sizes were larger than the average effect size of state anxiety and perceived stress in studies of MBSR with other groups with a range of .34 to .94 as reported by Carmody and Baer (2009). Some studies obtained smaller effect sizes at post-MBSR, but larger effect sizes at six months or one year follow-up (Carlson et al., 2001; Kieviet-Stijnen et al., 2008). The mindful attention awareness had a medium effect size in one study (Dobkin, 2008) and showed non-significant 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 this in the article (Hebert et al., 2001).

MBSR and Biological Outcomes

Four studies examined the effect of MBSR on biological outcomes (Carlson et al., 2007; Carlson et al., 2003; Carlson et al., 2004; Witek-Janusek et al., 2008). The studied variables included immune profile, blood pressure, heart rate, cortisol level, and melatonin level. Most variables had small effect sizes (less than 0.5), except cytokine production (IFN-λ, TNF, IL-4) which had a large effect sizes (>1.0) at six months and one year follow-up (Matchim, Armer, & Stewart, 2010 in press). Studies which included participants with breast and prostate cancer (Carlson et al., 2004) revealed that these two groups responded to MBSR in different ways on some biological outcomes. For example, male cortisol levels increased at 2 pm, whereas female cortisol levels decreased. In contrast, male melatonin decreased with a large effect size (0.95) while female melatonin increased (Matchim et al., 2010 in press). Tables of reviewed studies and effect sizes were attached in Appendix A.

Although a number of quantitative studies reported several significant positive outcomes of MBSR, few qualitative studies have been attempted to develop a conceptual understanding of the experience of practicing mindfulness meditation.

Matchim, Armer, and Stewart (2008) conducted a preliminary qualitative study that explored participants' perceptions of the effect of mindfulness meditation practice on self-care and overall well-being in healthy persons. Community-dwelling adults who had previously participated in an eight-week MBSR program and continued practicing MBSR were recruited into this study. Nine participants who consented were interviewed using a semi-structured interview guide. Data were analyzed using the editing style content analysis method (Crabtree & Miller, 1999). This study reported five major themes associated with MBSR practice: (1) promote sense of peace and relaxation, (2) promote health awareness and self-care concern, (3) promote self-management and responsibility, (4) promote sense of giving and sharing, and (5) fulfill a basic need for health and well-being. This study's findings suggested that practicing mindfulness meditation is strongly related to personal self-care and overall well-being. In addition, MBSR is noted as a self-care action chosen to maintain health and well-being and serves to meet existing self-care requisites in this group of community-dwelling adults.

Only one published qualitative study that explored the experience of practicing MBSR among cancer patients was found. Mackenzie et al. (2007) conducted a qualitative study with nine participants with different types, stages, and times of cancer diagnosis. Participants were recruited into the study based on their involvement in an on-going MBSR drop-in group and their capacity to provide information relevant to the area of inquiry. All participants had previously attended an introductory eight-week MBSR

course and were thus eligible for the drop-in group. Semi-structured interviews, focus group, and field notes were used to collect data; grounded theory was used to analyze data. Five major themes were reported as the theory concerning mechanisms whereby MBSR effects change for cancer patients: (1) opening to change; (2) self-control; (3) shared experience; (4) personal growth; and (5) spirituality. The limitation of the study was the participants were heterogeneous in types of cancer, including predominantly breast and prostate cancer patients.

Summary

This literature review revealed that MBSR has been examined quantitatively in a variety of samples in oncology settings and showed positive outcomes in physiological and psychological measurements. The lack of comparison groups and the inclusion of heterogeneous types and stages of cancer limit generalizability to early-stage breast cancer survivors. The present study was designed to close this gap by using a mixed-method design to gather data. A quasi-experimental, pre- and post-test control group design was used to collect quantitative data. Qualitative methods were used to gain conceptual knowledge and understanding about experience of practicing mindfulness meditation and how early-stage breast cancer survivors found the meditation helpful in their daily life.

CHAPTER THREE

METHODOLOGY

Research Design

This study used a mixed-method design of quantitative and qualitative approaches to examine effects of practicing mindfulness meditation on physiological and psychological outcomes. A quasi-experimental, pre- and post-test control group design was used to collect quantitative data which included heart rate (HR), respiratory rate (RR), blood pressure (BP), salivary cortisol, stress levels, mood disturbance, and mindfulness state. These variables were measured at baseline before participating in the program, immediately after the program completion, and follow-up at one month after the program completion. The intervention group received the eight-week MBSR program. The control group received no MBSR intervention. Qualitative methods using a semi-structured interview guide, non-participant observation, and field notes were used to collect data about what breast cancer survivors learned from practicing mindfulness meditation and how they used it in their daily lives.

Figure 3-1. Schematic of study design

	Baseline (T1)		Completion (T2)		One-month follow-up (T3)
Control group	x		x	1 month	x
Intervention group	x	8-week MBSR	x	O	x

x = psychological and physiological measures, O = in-depth interview

Data collection at T1, T2, and T3 included heart rate (HR), respiratory rate (RR), blood pressure (BP), stress levels, mood disturbance, mindfulness state, and salivary cortisol. At the first measurement time point, 10 participants in each group were randomly selected to measure salivary cortisol. The re-measurement of salivary cortisol at T2 and T3 was collected from same subjects. Data collection at each measurement time point (T1, T2, and T3) was completed in about one hour for each participant. After participants had HR, RR, and BP measurements taken by nurse researchers, they were asked to complete the checklist questionnaires (POMS, C-SOSI, FFMQ) and the demographic information. After the intervention completion, each participant in the intervention group was scheduled for an individual in-depth interview which took about thirty minutes to one hour. All interviews and transcription were completed by the researcher.

Sample

Human Subjects Assurance

The approval for conducting research with human subjects was received through the Health Sciences Institutional Review Board (IRB) office at the University of Missouri prior to initiation of the study (Appendix B).

Sample Size Determination

Sample size of this study was determined based on the effect size reported by previous studies. A recent meta-analysis (Grossman et al., 2004) reported the overall effect size of MBSR = 0.5 ($p < .0001$) with homogeneity of distribution. For studies of a two-group comparison examining the difference between mindfulness meditation and a control group, effect size on mental health was reported to be 0.54 ($p < .0001$); effect size

on physical health was reported to be 0.53 ($p < .0004$). For studies of pre-and post-test comparison of one-group design, effect size on mental health was reported to be 0.5 ($p < .0001$); effect size on physical health was reported to be 0.42 ($p < .0001$) (Grossman et al., 2004).

As the present study was a two-group comparison examining the difference between mindfulness meditation and a control group, the effect size of 0.53 was used for determining the sample size. Using a significance level of 0.05, effect size of 0.53, for a one-tailed test, a minimum sample size of 19 per group or a total of 38 subjects was sufficient to achieve a 80% power (Burns & Grove, 2005, p. 723). The study planned to recruit a total of 40 participants, including an increase of 5 percent of the sample size in order to deal with missing or dropout that may occur.

Inclusion Criteria

Participants included in this study were early-stage breast cancer survivors who met the following criteria:

1. Women age 18 years or older
2. Diagnosed with Stage 0, I, or II breast cancer
3. A minimum of three months after completing active treatment (surgery, radiation, or chemotherapy)
4. Speak and understand English
5. No active psychological disorder

Data Collection Methods

Instruments and Techniques

Demographic information and health behaviors. Demographic information collected in this study included age, education, marital status, and occupation. Medical history included type, stage, and date of breast cancer diagnosis, types and dates of treatment, co-morbid conditions, and all current medication. Information on health behaviors that may affect dependent variables was collected. This information included amount and frequency of tea, coffee, and soft-drinks with caffeine, alcohol consumption, smoking, and sleep problems (Appendix C).

Self-report of daily meditation practice at home. A self-report form provided by the course instructor and used in classes for home meditation practice was handed to participants in the intervention group to record practice duration in minutes, date, and MBSR forms that they practiced at home, as well as phenomena that they experienced in practicing mindfulness meditation such as feelings, thoughts, and sensations. Participants in the intervention group were asked to complete this form daily and return to the researcher weekly to eliminate reporting bias. The self-report form is currently used by class participants in MU meditation classes (Appendix D).

Profile of mood states (POMS) short form. Mood disturbance was measured by using the POMS short form (McNair, Lorr, & Droppelman, 1971), a 30-item self-report instrument used to assess 6 components of mood state (tension-anxiety, depression-dejection, anger-hostility, fatigue-inertia, vigor-activity, and confusion-bewilderment) over a period of 1 week (Appendix E). It is a five-point scale on which 0 equaled ‘Not at all’ and 4 equaled ‘Extremely.’ The 30-item short form rather than the 65-item Profile of

Mood States was used to reduce demands on the respondents. The 30-item short form has high internal consistency reliability (Cronbach α = .75-.90) and has been validated with a wide variety of patients (Speca et al., 2000). Higher scores indicate more total mood disturbance. Carlson et al. (2001) used the POMS to measure mood disturbance in cancer patients, including breast cancer patients, who practiced mindfulness meditation and reported that more home practice and higher initial POMS scores predicted improvement on the POMS between the pre-and post-intervention scores. In the review of measuring the psychological impact of mindfulness meditation on health among patients with cancer, the POMS was suggested as a reliable instrument (Matchim & Armer, 2007).

Calgary Symptoms of Stress Inventory (C-SOSI). The Calgary Symptoms of Stress Inventory (Carlson & Thomas, 2007) was developed by Carlson and Thomas. It is a 56-item scale (down from the original SOSI which included 94 items) with 8 subscales, each consisting of 6-9 items named: Depression, Anger, Muscle Tension, Cardiopulmonary Arousal, Sympathetic Arousal, Neurological/GI, Cognitive Disorganization, and Upper Respiratory Symptoms (Appendix F). The C-SOSI was administered to 344 cancer patients registered for a stress-management program. Scores on the revised C-SOSI were correlated with scores on measures of quality of life, mood disturbance, sleep, and spirituality to begin investigation of convergent and discriminant validity. Cronbach's alpha reliabilities for the subscales ranged from 0.80 to 0.95 (Carlson & Thomas, 2007). Convergent and discriminant validity was supported by correlations with other measures as conceptually predicted. The authors concluded that the C-SOSI is a reliable tool with converging validity for assessing stress symptoms in an oncology population.

Five Facet Mindfulness Questionnaire (FFMQ). The Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) was derived from a factor analysis of questions measuring a trait-like general tendency to be mindful in daily life. It consists of 39 items assessing five facets of mindfulness: observing (attending to or noticing internal and external stimuli, such as sensations, emotions, cognitions, sights, sounds, and smells), describing (noting or mentally labeling these stimuli with words), acting with awareness (attending to one's current actions, as opposed to behaving automatically or absent-mindedly), non-judging of inner experience (refraining from evaluation of one's sensations, cognitions, and emotions) and non-reactivity to inner experience (allowing thoughts and feelings to come and go, without attention getting caught up in them) (Appendix G). Items are rated on a Likert scale ranging from 1 (never or very rarely true) to 5 (very often or always true). It was tested for meditation intervention in clinical and healthy settings, as well as in meditating and nonmeditating samples (Baer et al., 2008). The FFMQ has been shown to have good internal consistency, with alpha coefficients ranging from .75 to .91, and significant relationships in the predicted directions with a variety of constructs related to mindfulness, such as experiential avoidance, thought suppression, openness to experience, and emotional intelligence (Baer et al., 2006). Regression and mediation analyses showed that several of the facets contributed independently to the prediction of well-being and significantly mediated the relationship between meditation experience and well-being (Baer et al., 2008).

Physiological measures. Physiological measures included heart rate (HR), respiratory rate (RR), and blood pressure (BP).At each assessment time point, HR, RR, and

BP were measured and recorded twice. The average value of these two measures was used for analysis. These physiological measurements were performed by the nurse researcher. BP was measured on the arm of the side not affected by cancer. For a person with both arms affected, BP was measured on either leg, the same site at all assessment time points. These physiological variables were recorded on the biological data collected form (Appendix H).

Cortisol level. Cortisol is a vital hormone secreted from the adrenals. Cortisol is often referred to as the "stress hormone." In healthy people, the amount of cortisol presenting in the blood undergoes diurnal variation, the highest levels present in the early morning, and the lowest levels present around midnight, three to five hours after the onset of sleep. Studies have shown that serum cortisol is significantly correlated with salivary cortisol (Cadore et al., 2008; Restituto et al., 2008). There are three previous studies (Carlson et al., 2007; Carlson et al., 2004; Witek-Janusek et al., 2008) that examined cortisol level in MBSR intervention among breast cancer patients. Two of these studies (Carlson et al. 2004, 2007) which were conducted with 49 breast and 10 prostate cancer patients measured salivary cortisol. At each measurement point, these studies collected salivary cortisol three times (8 AM, 2 PM, 8 PM). One study (Witek-Janusek et al., 2008) which was conducted with 66 breast cancer patients measured plasma cortisol at pre-mid-post MBSR and at one-month follow-up. At each measurement point, plasma cortisol was collected only a single time, between 4 to 6 PM. In sum, the results of previous studies showed that cortisol levels decreased systematically over the course of MBSR and the follow-up measurement. Participants in the MBSR program had significantly reduced cortisol levels compared to the non-MBSR group. However, improvements in quality of

life were associated with decreases in afternoon cortisol levels, not with morning or evening cortisol levels (Carlson et al., 2004). In addition, this study found approximately 40% of the sample demonstrated abnormal cortisol secretion patterns both pre-and post-intervention, but within that group patterns shifted from "inverted-V-shaped" patterns towards more "V-shaped" patterns of secretion over time.

In this present study, at each measurement time point, salivary cortisol was measured two times per day, at the time of awaking and at 4 PM. This is the first study that measured salivary cortisol in MBSR intervention with a sample of breast cancer survivors alone. Salivary collecting sets were given at the first orientation. Due to the expense of the salivary cortisol analysis, only 10 participants in each group were randomly selected to measure salivary cortisol. These participants were trained by the researcher to swab saliva in their mouths within 30 minutes after waking and at 4 PM. They were instructed to freeze the specimens in their home refrigerator and bring them to the researcher at the program meeting. Then the specimens were packaged on dry ice and shipped to the laboratory in Pennsylvania for analysis.

Instructions for Salivary Collection

I. The Morning Sample

Participants were informed that the most accurate morning cortisol is done within 30 minutes after waking up. They were instructed to collect the morning sample by following these instructions:

1. Do not eat, drink, smoke, or brush your teeth until after you collect the sample. (It is OK to drink water).
2. Rinse your mouth out with water and wait 10 minutes.

3. You will have a new tube and swab. The morning tube says AM.
4. Take the swab out of the tube. Put it under your tongue until it gets wet, for about 1 or 2 minutes.
5. Put the swab back into the tube and put the cap back on.
6. Put the whole thing, tube and swab, into your freezer immediately.
7. Check it off on the diary. Make a note if there were any problems or questions.

II. The Afternoon Sample (4 PM)

1. Do not eat, drink, smoke, or brush your teeth for 30 minutes before you collect the sample. (It is OK to drink water).
2. Rinse your mouth out with water and wait 10 minutes.
3. Use a new afternoon tube and swab. The afternoon tube says PM.
4. Take the swab out of the tube. Put it under your tongue until it gets wet, for about 1 or 2 minutes.
5. Put the swab back into the tube and put the cap back on.
6. Put the whole thing, tube and swab, into your freezer immediately.
7. Match the number on the tube with the number on the diary. Check it off on the diary. Make a note if there were any problems or questions.

Qualitative Data

Participants in the intervention group were observed by the researcher in every session of the MBSR class. Class discussions were tape-recorded. Field notes were made and transcribed for every session. At the end of the eight weeks, after the MBSR completion, each participant in the intervention group was scheduled to be interviewed by the researcher about what they found helpful in their daily lives, and their experience in practicing mindfulness meditation, including noticing or attending to internal and

external experiences, such as bodily sensations, cognitions, emotions, sights, sounds, and smells. The change in their thoughts, feelings, and perceptions about themselves and others, as well as particular phenomena occurring during meditation practice, were explored. All interviews were conducted by the researcher at times and places that were convenient for each participant. The interview took about thirty minutes to one hour. A semi-structured interview guide (Appendix J) was used for the interview. All interviews were transcribed by the researcher and saved on the personal computer using password protection which could be accessed by only the researcher.

Intervention

The Mindfulness-Based Stress Reduction (MBSR) program lasted 8 weeks. The brief description of the program content week-by-week is as follow:

Week 1. A rationale and overview of the intervention was introduced. MBSR manuals and CDs were given, and group rules (eg, confidentiality, regular attendance, home practice, and record keeping) were explained. Participants were led through an exercise focusing on full and relaxed breathing and guided awareness of bodily sensation. Home practice and daily record were assigned and explained.

Week 2. The content focused on the interaction of mental imagery and bodily responses. Gentle yoga stretches were introduced. Principles and practices of meditation were further developed through a body scan exercise that led participants through a process of perceiving kinesthetic feedback from each area of the body.

Week 3. Activities involved group discussion and problem-solving about home practice. The body's response to stress, the relaxation response, and the physiological correlates were taught. Attentional processes which related to the practice of mindfulness

meditation were outlined and illustrated through a guided meditation exercise. Mindful practice of gentle yoga stretches was continued in this and all remaining sessions.

Week 4. The reciprocal relationship between patterns of breathing and emotional response was explored through breathing exercises. A walking mindfulness meditation was introduced as a way of extending the practice into multiple contexts.

Week 5. The relationship between cognition and emotion was explored and discussed. Application of mindfulness to the awareness of thought processes was explored. The nature of cognitive distortions and irrational assumptions and beliefs was explained. Homework related self-monitoring of cognitive appraisal associated with stressful experiences and practice was assigned.

Week 6. The self-monitoring assignment was reviewed and discussed. Visualization and imagery as adjuncts to meditative practice were taught. Focusing awareness on a chosen image during guided meditation was practiced. The full day retreat was held in this week.

Week 7. All mindfulness techniques were reviewed, practiced and discussed.

Week 8. All important content was emphasized. Participants were challenged to develop their own plan to continue practicing mindfulness meditation. Related resources about meditation practice in the community were described and discussed.

Procedures

Recruitment

Potential participants were recruited by announcements in the breast cancer clinic at Ellis Fischel Cancer Center, the state cancer center, Missouri Cancer Associates, a private oncology practice, the Mid-Missouri Breast Cancer Awareness Support group;

and the Jefferson City Cancer Awareness Support Encouragement Through Caring group, as well as at other area breast cancer survivors' support groups, community survivorship events, women's beauty salons in Columbia, and word-of-mouth techniques. The announcement is attached in Appendix K.

Screening and Informed Consent

After participants volunteered to participate in this study, they were screened by the nurse researcher to see if they met the inclusion criteria. Potential participants were informed about the purposes of the study, how participants would be contacted, and how data would be collected. Participants who agreed to participate in this study were scheduled for the first meeting to sign the informed consent form and complete the first assessment. Participants were informed about standard principles of human subjects' protection, including the right to refuse, withdraw, or stop participating in the study. All participants were provided written informed consent under principles of full disclosure and were given a copy of the consent form (Appendix L).

Previously, the study was designed as a randomized control trial. The design was changed to the quasi-experimental, pre- and post-test control group design later due to the fact that breast cancer survivors in Columbia self-selected to participate in the intervention group. As the MBSR class was offered in Columbia, no one in Columbia wanted to be in the control group; all wanted to participate in the MBSR intervention group. Eventually, the researcher invited breast cancer survivors in Jefferson City to participate in the control group.

Data Management and Analysis

Quantitative Data

The researcher checked the data collection instruments for completeness and accuracy at each measurement time point. After collection, data were entered promptly into the personal computer using a protected password that can be accessed by only the researcher. Quantitative data were entered in two separate Excel spread sheets in order to compare for accuracy. All hard copies of answered questionnaires and checked lists were kept in series and taken care of carefully. These documents could be rechecked promptly, if needed. Quantitative data analyses were undertaken by a statistician from the Department of Biostatistics, University of Missouri, using SAS 9.0 (SAS Institute Inc, Cary, NC). The analyses were conducted at a pre-set significance level of 0.01 and 0.05.

The demographic data, medical history, and health behavior information were described by descriptive statistics such as frequencies, percentage, means, and standard deviation.

Quantitative data of other variables were checked for normality and outliners before performing data analysis. Normality of each variable was examined by a goodness of fit test and the shape in the histograms. Outliners were examined using Box Plot and the Stem-and Leaf Plot. The standardized residuals of 3 or greater were used to indicate outliers or possible non-normality. In cases where residuals were greater than 3 (in absolute value), the analysis was re-performed excluding these outliers. If the conclusions about the significance of effects are the same with and without outliers, we have more confidence in the reported results. If different conclusions are found in analysis with and without outliers, we have less confidence in the reported results. In this study, the

reported results are confident for all variables except salivary cortisol for which one person had a very extreme value at T2 measurement time point. The researcher checked in this person's diary of collecting salivary samples and found that she had surgery one week before collecting this sample. After the surgery, she had an infection and was given antibiotics (Bactrim and Keflex). At the time of collecting the sample, she developed a severe rash and restlessness. As there were many factors that may have affected her cortisol level, her cortisol value at T2 was excluded from the analysis.

Data Analyses based on Each Research Question

For the first hypothesis which examined whether there were group differences in the variables of interest (systolic blood pressure, diastolic blood pressure, heart rate, respiratory rate, morning cortisol, afternoon cortisol, mood disturbance, symptoms of stress, and mindfulness state) at the baseline measurement, an analysis of variance was performed. The second hypothesis was addressed by treating the baseline value as a covariate and performing an analysis of covariance. Group was a between-subjects factor (with two levels) and Time was a within-subjects factor (with two levels). The third and the forth hypotheses were addressed by performing a two-factor analysis of variance. Group was a between-subjects factor (with two levels) and Time was a within-subjects factor (with three levels). The differences between time 1 (baseline) and either time 2 or time 3 were examined for each group separately. A Group-by-Time interaction term was included. Pairwise comparisons were performed using a Least Squares Means procedure. When there was a covariate, the Least Squares Means procedure reported the mean values as both groups had the same values at baseline. This adjusts for baseline

differences whether or not the differences were statistically significant (Madsen, personal communication, 1/2010).

Qualitative Data

The qualitative data were managed and analyzed using the following processes:

1. Qualitative data were obtained from fifteen participants in the MBSR intervention group through audiotaped in-depth interviews, audiotaped class discussions, and field notes.
2. All data were transcribed by the researcher
3. Each transcription was given to the participant for clarifying on the day of follow-up measurement.
4. All transcriptions were revised and completed as each participant commented and suggested.
5. Data analysis was performed using content analysis.
6. Each transcription was read several times to make sense of the data as a whole.
7. The researcher organized phases by opening codes, creating sub-categories, categories, and abstraction.
8. Open coding involved writing notes and headings in the text; then generating them into sub-categories. When a code list and definition of each code was made, it was continually revised as a new code was added.
9. These codes were then grouped into sub-categories based on the terms which were described.

10. Sub-categories with similar events and incidences were formulated into categories.
11. Categories were grouped in higher headings as main categories or themes.
12. The credibility of the qualitative data in this study, which refers to the confidence one can have in the truth of the finding, was established by conducting non-participant observation in every session of the MBSR class, the full-day retreat, as well as conducting in-depth interviews after the MBSR completion, and member checks.
13. Transferability or generalizability of the findings was accomplished by providing rich, thick slices of data to make transferability judgments possible on the part of potential readers, such as experts in this field, people who work in oncology settings with an interest in mindfulness meditation.
14. Dependability, which refers to the stability of the findings over time, was achieved by conducting non-participant observation in every section of the MBSR class and the full-day retreat. Class discussions in every session were tape-recorded.
15. Confirmability, which refers to the objectivity or neutrality of the data, was accomplished by using an audit trail. The transcription, field notes, on-going data analysis, and findings were shared with the dissertation co-advisers who are experts in this field. The categories and findings were discussed and revised as needed before reporting.

Summary

The study used a mixed-method, quasi-experimental, pre- and post-test control group design with qualitative approaches. The sample consisted of 36 early-stage breast cancer survivors self-selected to participate in the intervention (n =19) and the control (n =17) groups. After the first measurement and first MBSR class meeting, three participants in the intervention group discontinued participation in the study due to: two participants were not able to drive in the evening (after class); one participant was diagnosed with cancer metastasis. After the second MBSR class meeting, one participant dropped out from the intervention group due to a schedule conflict. A total of 32 participants completed the study, the intervention group (n =15) and the control group (n =17). The outcome measurements, heart rate (HR), respiratory rate (RR), blood pressure (BP), salivary cortisol, stress levels, mood disturbance, and mindful states were measured at baseline, immediately after the intervention completion, and one-month follow-up. The intervention group received the eight-week MBSR program. The control group received no MBSR intervention. ANCOVA was used to examine group differences at either measurement time point on any of the seven outcome variables. A two-factor ANOVA was used to examine whether there were changes from baseline, within either group on any of the seven outcome variables. Qualitative data were derived from interviews with 15 participants in the intervention group, non-participant observation and field notes, as well. Qualitative data were analyzed using editing style content analysis.

CHAPTER FOUR

RESULTS

The present study examined the effects of Mindfulness-Based Stress Reduction (MBSR) on physiological and psychological outcomes among early-stage breast cancer survivors. Outcome variables including blood pressure (BP), heart rate (HR), respiratory rate (RR), salivary cortisol, mood disturbance, symptoms of stress, and mindfulness state were measured at baseline, immediately after the intervention completion, and at one-month follow-up. In addition, experience of practicing mindfulness meditation and how participants found meditational techniques useful in their daily lives were explored. Two sets of research finding are presented in this chapter. In part one, the sample is described with descriptive statistics such as frequencies, percentage, means, and standard deviation. Quantitative findings of each outcome variable are presented in response to research questions and hypotheses. In part two, qualitative findings are presented in response to interview questions and themes which emerged from the analysis.

Quantitative Findings

Demographic Characteristics of the Sample

A total of thirty-six early-stage breast cancer survivors consented to participate in the study: nineteen in the intervention group, and seventeen in the control group. Four participants dropped out from the intervention group due to the following reasons: two unable to drive in the evening; one was diagnosed with cancer metastasis; and one had a

schedule conflict. Thirty-two participants completed the study, fifteen in the intervention group and seventeen in the control group.

The intervention group ranged in age from 38 to 71 years with a mean age of 56.87 years old (SD = 9.17). Years of education ranged from 12 to 22 years with a mean of 16.13 years (SD = 2.95). Time after diagnosis ranged from 5 months to 16 years with a mean of 6.73 years (SD = 0.68). The majority of participants in the intervention group were White (86.67%), Christian (86.7%), married (80%), and had no co-morbidities (73.3%). Most of them were diagnosed with Stage I-to-II breast cancer (86.6%) with the right side affected (60%). About half of them reported having sleep problems (53.3%), and most reported adequate-to-good sleep quality (86.7%), and adequate-to-good diet quality (100%).

Age of the control group ranged from 34 to 82 years with a mean age of 61.47 years old (SD = 10.87). Years of education ranged from 11 to 22 years with a mean of 14.71 years (SD = 3.33). Time after diagnosis ranged from 2 months to 26 year with a mean of 10.02 years (SD = 1.83). The majority of participants in the control group were White (100%), Christian (76.5%), married (64.7%), and had no co-morbidities (58.8%). Most of them were diagnosed with breast cancer Stage I and unknown stage (64.7%) with the right side affected (64.7%). The majority of them reported no sleep problem (70.6%), adequate-to-good sleep quality (88.2%), and adequate-to-good diet quality (94.1%).

In summary, the most characteristics of the intervention and the control group were similar. The control group tended to be older (mean 61.47 vs 56.87 years); time after diagnosis of breast cancer longer (mean 10.02 vs 6.73 years), more reported

co-morbidities (41.2 vs 26.7 %), and less reported sleep problems (29.4 vs 53.3%). The overall demographic characteristics of the sample are presented in Table 4-1.

Table 4-1

Sample Demographic and Medical Characteristics

Characteristics	Intervention group (n = 15)		Control group (n = 17)	
	M	SD	M	SD
Age	56.87	9.17	61.47	10.78
Year of Education	16.13	2.95	14.71	3.33
Time after diagnosis	6.73	0.68	10.02	1.83
	(n)	%	(n)	%
Ethnicity				
White	13	86.67	17	100
African-American	2	13.33	-	-
Religion				
Christian	13	86.7	13	76.5
Universal	1	6.7	1	5.9
Jewish	1	6.7	-	-
Catholic	-	-	2	11.8
Buddhist	-	-	1	5.9
Marital Status				
Single	-	-	2	11.8
Married	12	80	11	64.7
Divorced/Separated/Widow	3	20	4	23.6
Reported co-morbid condition(s)				
No	11	73.3	10	58.8
Yes	4	26.7	7	41.2

(table continues)

Table 4-1 *(continued)*

	(n)	(%)	(n)	(%)
Affected Side				
Left	5	33.3	5	29.4
Right	9	60.0	11	64.7
Left & Right	1	6.7	1	5.9
Stage of Breast Cancer				
0	1	6.7	3	17.6
I	11	73.3	7	41.2
II	2	13.3	3	17.6
Unknown	1	6.7	4	23.5
Sleep Problem				
No	7	46.7	12	70.6
Yes	8	53.3	5	29.4
Sleep Quality				
Poor	2	13.3	2	11.8
Adequate	9	60.0	9	52.9
Good	4	26.7	6	35.3
Diet Quality				
Poor	0	0	1	5.9
Adequate	6	40	7	41.2
Good	9	60	9	52.9

Analysis of Quantitative Data in Response to Research Questions

Quantitative data analysis was performed on data collected in response to the following research questions:

1. Is there a difference in physiological and psychological outcomes between breast cancer survivors who participate in the MBSR program and those in the control group at baseline (T1)?

2. Is there a difference in physiological and psychological outcomes between breast cancer survivors who participate in the MBSR program and those in the control group at:

    2a: the measurement immediately after the MBSR completion (T2)?

    2b: at one-month follow-up (T3)?

3. Is there a difference in physiological and psychological outcomes within breast cancer survivors who participate in the MBSR program at:

    3a: the measurement immediately after the MBSR completion (T2), as compared to baseline (T1)?

    3b: one-month follow-up (T3), as compared to baseline (T1)?

4. Is there a difference in physiological and psychological outcomes within breast cancer survivors who are in the control group at:

    4a: the measurement at T2, as compared to baseline (T1)?

4b: the measurement at T3, as compared to baseline (T1)?

Regarding research questions, the following hypotheses were tested:

H_1: Breast cancer survivors who participate in the MBSR program and those in the control group are not significantly different in the variables of interest (systolic blood pressure, diastolic blood pressure, heart rate, respiratory rate, morning cortisol, afternoon cortisol, mood disturbance, symptoms of stress, and mindfulness state) at the baseline measurement.

H_2: Breast cancer survivors who participate in the MBSR program will have a statistically significant improvement in physiological and psychological outcomes when compared to those in the control group:

H_{2a}: at the measurement immediately after the MBSR completion (T2).

H_{2b}: at one-month follow-up (T3).

H_3: Breast cancer survivors who participate in the MBSR program will have a statistically significant improvement in their physiological and psychological outcomes:

H_{3a}: at the measurement immediately after the MBSR completion (T2), as compared to baseline (T1).

H_{3b}: at one-month follow-up (T3), as compared to baseline (T1).

H_4: Breast cancer survivors who are in the control group will <u>not</u> have a statistically significant improvement in their physiological and psychological outcomes:

H_{4a}: at the measurement at T2, as compared to baseline (T1).

H_{4b}: at the measurement at T3, as compared to baseline (T1).

The meaning of improvement for each variable is described as follow:

Physiological variables:

- Systolic blood pressure (SBP): decrease in the measurement in mmHg at T2 and T3.
- Diastolic blood pressure (DBP): decrease in the measurement in mmHg at T2 and T3.
- Heart rate (HR): decrease in the measurement in beats/min at T2 and T3.
- Respiratory rate (RR): decrease in the measurement in breaths/min at T2 and T3.
- Morning cortisol (AM cor): decrease in the measurement in micrograms per deciliter (ug/dl) at T2 and T3.
- Afternoon cortisol (PM cor): decrease in the measurement in micrograms per deciliter (ug/dl) at T2 and T3.

Psychological variables:

- Mood disturbance (POMS): decrease in the measurement in POMS score at T2 and T3.
- Symptoms of stress (C-SOSI): decrease in the measurement in C-SOSI score at T2 and T3.
- Mindfulness state (FFMQ): increase in the measurement in FFMQ score at T2 and T3.

The abbreviation of each variable will be used in this chapter. Hypotheses will be similarly abbreviated for each variable under consideration. For example, H_1 for the comparison of systolic blood pressure in the intervention and control group at baseline (T1) will be designed as: $H_{1\text{-SBP}}$. Likewise, the hypothesis for the comparison of diastolic blood pressure in H_1 will be designed as $H_{1\text{-DBP}}$.

The first hypothesis was addressed using an analysis of variance (ANOVA) to test whether the baseline values of each variable between groups were different. Then the second hypothesis was addressed by treating the baseline value as a covariate and

performing an analysis of covariance (ANCOVA). Group was a between-subjects factor (with two levels) and Time was a within-subjects factor (with two levels). The third and the forth hypotheses were addressed by performing a two-factor analysis of variance. Group was a between-subjects factor (with two levels) and Time was a within-subjects factor (with three levels). In data analysis, the differences between time 1 (baseline) and either time 2 or time 3 were considered for each group separately. A Group-by-Time interaction term was included. Pairwise comparisons were performed using a Least Squares Means procedure. When there is a covariate, the Least Squares Means procedure gives the values of the mean as both groups had the same value at baseline.

The results of quantitative data analysis are presented in response to the above hypotheses for each outcome variable. The number of samplings of each variable at each measurement time point included in the data analysis is presented in Table 4-2.

Table 4-2

Number of samplings of each variable at each measurement time point

Outcome variables	T1		T2		T3	
	Control group (n)	Intervention group (n)	Control group (n)	Intervention group (n)	Control group (n)	Intervention group (n)
Systolic blood pressure (SBP)	17	19	17	15	17	14
Diastolic blood pressure (DBP)	17	19	17	15	17	14
Heart rate (HR)	17	19	17	15	17	14
Respiratory rate (RR)	17	19	17	15	17	14
Morning cortisol (AM cor)	11	10	10	9	11	9
Afternoon cortisol (PM cor)	11	10	10	9	11	8
Mood disturbance (POMS)	17	19	17	15	17	14
Symptoms of stress (C-SOSI)	17	19	17	15	17	14
Mindfulness state (FFMQ)	17	19	17	15	17	14

T1 = baseline, T2 = immediately after the intervention completion, T3 = one-month follow-up

Effects of MBSR on Each Outcome Variable Response to Hypotheses

Physiological outcome variables

1) Systolic blood pressure (SBP)

In order to test the hypotheses, the changes in systolic blood pressure (SBP) between the intervention and the control groups were assessed at baseline (T1), immediately after the intervention completion (T2), and at one-month follow-up (T3). Figure 4-1 and Table 4-3 demonstrate the mean systolic blood pressures in the intervention and control groups by time. Results in between-and within-group comparisons at baseline, immediately after the intervention completion, and at one-month follow-up are displayed in Table 4-4 and Table 4-5 respectively.

Between-group comparisons by time. Mean systolic blood pressure in the intervention group was significantly higher than that of the control group at baseline ($p < .05$); it was significantly lower than that in the control group at one-month follow-up ($p < .05$) (Table 4-4).

Within-group comparisons by time. There was no statistically significant difference in systolic blood pressure within either the intervention or the control group (Table 4-5).

Thus, for systolic blood pressure, $H_{1\text{-SBP}}$ is rejected as the intervention group had statistically significantly higher systolic blood pressure than those in the control group at baseline.

$H_{2a\text{-SBP}}$ is rejected as the intervention group had no statistically significant decrease in systolic blood pressure when compared to the control group at the measurement immediately after the intervention completion. $H_{2b\text{-SBP}}$ is accepted as the

intervention group had a statistically significant decrease in systolic blood pressure when compared to the control group at one-month follow-up.

$H_{3a\text{-}SBP}$ is rejected as the intervention group had no statistically significant decrease in systolic blood pressure at the measurement immediately after the intervention completion when compared to baseline. Similarly, $H_{3b\text{-}SBP}$ is rejected as the intervention group had no statistically significant decrease in systolic blood pressure at one-month follow-up when compared to baseline.

$H_{4a\text{-}SBP}$ is accepted as there was no statistically significant decrease in systolic blood pressure within the control group at the measurement at T2 when compared to baseline (T1). Likewise, $H_{4b\text{-}SBP}$ is accepted as there is no statistically significant decrease in systolic blood pressure within the control group at the measurement at T3 when compared to baseline (T1).

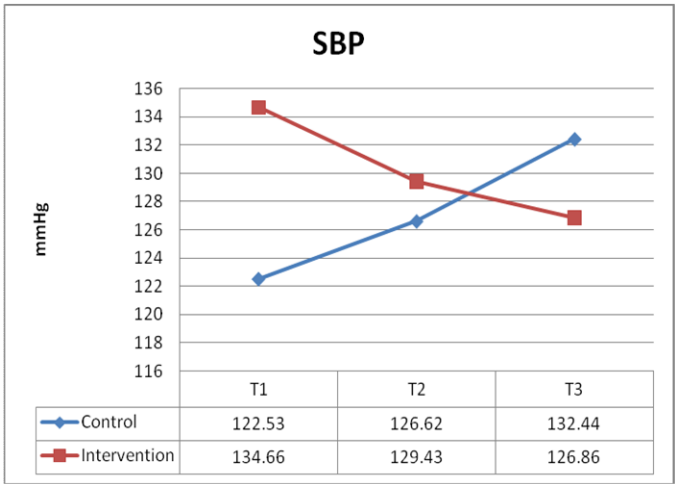

Figure 4-1. Mean systolic blood pressure (SBP) in the control group and the intervention group at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Table 4-3

Least Squares Means systolic blood pressure (SBP) in the control group (1) and the intervention group (2) at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Group	time	Estimate Mean	Standard Error	DF	t Value	Pr > | t |	Lower	Upper
1	1	122.53	4.07	59	30.12	<.0001	114.39	130.67
1	2	126.62	4.07	59	31.13	<.0001	118.48	134.76
1	3	132.44	4.07	59	32.56	<.0001	124.30	140.58
2	1	134.66	3.85	59	35.00	<.0001	126.96	142.36
2	2	129.43	4.33	59	29.89	<.0001	120.77	138.10
2	3	126.86	4.48	59	28.30	<.0001	117.89	135.83

Table 4-4

Difference in mean systolic blood pressure (SBP) between groups at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

group	time	_group	_time	Estimate difference	Standard Err	DF	t value	p value	Lower	Upper
1	1	2	1	-12.13	5.60	59	-2.17	0.0343*	-23.33	-0.92
1	2	2	2	1.30	5.03	29	0.26	0.7975	-8.98	11.58
1	3	2	3	10.64	5.17	29	2.06	0.0489*	0.057	21.21

group 1 = control, group 2 = intervention, *p < .05

Table 4-5

Difference in mean systolic blood pressure (SBP) within group

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	1	2	-4.09	5.75	59	-0.71	0.4801	-15.60	7.42
1	1	1	3	-9.91	5.75	59	-1.72	0.0901	-21.42	1.60
1	2	1	3	-5.82	4.76	29	-1.22	0.2306	-15.55	3.90
2	1	2	2	5.22	5.79	59	0.90	0.3708	-6.37	16.82
2	1	2	3	7.80	5.91	59	0.19	0.1917	-4.02	19.62
2	2	2	3	3.51	5.16	29	0.68	0.5015	-7.04	14.06

group 1 = control, group 2 = intervention

2) Diastolic blood pressure (DBP)

The changes in diastolic blood pressure (DBP) between the intervention and the control groups were assessed at baseline (T1), immediately after the intervention completion (T2), and at one-month follow-up (T3). Figure 4-2 and Table 4-6 demonstrate the mean diastolic blood pressure of the intervention and control groups by time. Results in between-and within-group comparisons at baseline, immediately after the intervention

completion, and at one-month follow-up are displayed in Table 4-7 and Table 4-8 respectively.

Between-group comparisons by time. There was a statistically significant difference in mean diastolic blood pressure between the intervention and control groups at one-month follow-up. Mean diastolic blood pressure in the intervention group was lower than that in the control group at one-month follow-up ($p < .001$). The mean diastolic blood pressure in the intervention group was higher than that in the control group at baseline, but the difference was not statistically significant ($p = 0.097$) (Table 4-7).

Within-group comparisons by time. There was a statistically significant decrease in diastolic blood pressure within the intervention group at the intervention completion and at one-month follow-up from baseline ($p < .05$). In contrast, the control group had a statistically significant increase diastolic blood pressure at one-month follow-up (T3), as compared to the measurement at T2 ($p < .05$) (Table 4-8).

Thus, for diastolic blood pressure, $H_{1\text{-}DBP}$ is accepted as diastolic blood pressure of the intervention group and those in the control group were not significantly difference at the baseline measurement.

$H_{2a\text{-}DBP}$ is rejected as the intervention group had no statistically significant decrease in diastolic blood pressure when compared to the control group at the measurement immediately after the intervention completion (T2). $H_{2b\text{-}DBP}$ is accepted as the intervention group had a statistically significant decrease in diastolic blood pressure when compared to the control group at one-month follow-up.

$H_{3a\text{-}DBP}$ is accepted as there was a statistically significant decrease in diastolic blood pressure within the intervention group at the measurement immediately after the

intervention completion (T2) when compared to baseline (T1). Similarly, $H_{3b\text{-}DBP}$ is accepted as there was a statistically significant decrease in diastolic blood pressure within the intervention group at one-month follow-up (T3) when compared to baseline (T1).

$H_{4a\text{-}DBP}$ is accepted as there was no statistically significant decrease in diastolic blood pressure within the control group at the measurement at T2 when compared to baseline (T1). Likewise, $H_{4b\text{-}DBP}$ is accepted as there was no statistically significant decrease in diastolic blood pressure within the control group at the measurement at T3 when compared to baseline (T1).

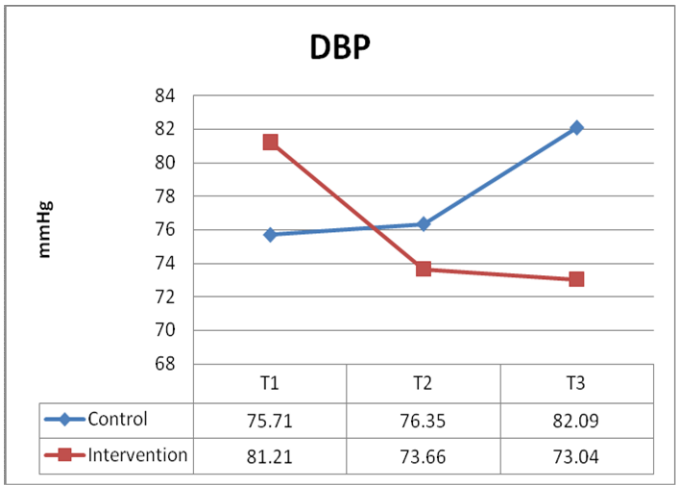

Figure 4-2. Mean diastolic blood pressure (DBP) in the control group and the intervention group at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Table 4-6

Least Squares Means in diastolic blood pressure (DBP) in the control group (1) and the intervention group (2) at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Group	time	Estimate Mean	Standard Error	DF	t value	Pr > | t |	Lower	Upper
1	1	75.71	2.37	59	31.92	<.0001	70.96	80.45
1	2	76.35	2.37	59	32.19	<.0001	71.61	81.10
1	3	82.09	2.37	59	34.61	<.0001	77.34	86.83
2	1	81.21	2.24	59	36.20	<.0001	76.72	85.70
2	2	73.66	2.52	59	29.18	<.0001	68.61	78.72
2	3	73.04	2.61	59	27.95	<.0001	67.81	78.26

Table 4-7

Difference in mean diastolic blood pressure (DBP) between groups at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

group	time	_group	_time	Estimate difference	Stand Error	DF	t value	p value	Lower	Upper
1	1	2	1	-5.50	3.26	59	-1.69	0.0970	-12.04	1.03
1	2	2	2	3.94	2.72	29	1.45	0.1579	-1.62	9.49
1	3	2	3	10.74	2.78	29	3.86	0.0006***	5.05	16.44

group 1 = control, group 2 = intervention, ***p < .001

Table 4-8

Difference in mean in diastolic blood pressure (DBP) within group

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	1	2	-0.65	3.35	59	-0.19	0.8477	-7.36	6.06
1	1	1	3	-6.38	3.35	59	-1.90	0.0619	-13.09	0.33
1	2	1	3	-5.74	2.61	29	-2.20	0.0360*	11.07	-0.40
2	1	2	2	7.54	3.38	59	2.23	0.0293*	0.78	14.30
2	1	2	3	8.17	3.44	59	2.37	0.0209*	1.28	15.07
2	2	2	3	1.07	2.83	29	0.38	0.7084	-4.72	6.85

group 1 = control, group 2 = intervention, *p < .05

3) Heart Rate (HR)

The changes in heart rate (HR) between the intervention and the control groups were assessed at baseline (T1), immediately after the intervention completion (T2), and at one-month follow-up (T3). Figure 4-3 and Table 4-9 demonstrate the mean heart rate of the intervention and control groups by time. Results in between- and within-group comparisons at baseline, immediately after the intervention completion, and at one-month follow-up are displayed in Table 4-10 and Table 4-11, respectively.

Between-group comparisons by time. There was a statistically significant difference in mean heart rate between the intervention and control groups at one-month follow-up. The mean heart rate of the intervention group was statistically significant lower than that of the control group at one-month follow-up ($p < .05$). There were no statistically significant differences in mean heart rate between the two groups at baseline and immediately after the intervention completion (Table 4-10).

Within-group comparisons by time. There were no statistically significant decreases in heart rate within the intervention group at the intervention completion and at one-month follow-up from baseline. Heart rate of the control group increased significantly at one-month follow-up, as compared to the measurement at T2 ($p < .05$) (Table 4-11).

Thus, for heart rate, $H_{1\text{-}HR}$ was accepted as heart rate of the intervention group and those in the control group are not statistically significant difference at the baseline measurement.

$H_{2a\text{-}HR}$ is rejected as the intervention group had no statistically significant decrease in heart rate when compared to the control group at the measurement immediately after the intervention completion (T2). $H_{2b\text{-}HR}$ is accepted as the intervention group had a statistically significant decrease in heart rate when compared to the control group at one-month follow-up (T3).

$H_{3a\text{-}HR}$ is rejected as there is no statistically significant decrease in heart rate within the intervention group at the measurement immediately after the intervention completion (T2) when compared to baseline (T1). Similarly, $H_{3b\text{-}HR}$ is rejected as there is no statistically significant decrease in heart rate within the intervention group at one-month follow-up (T3) when compared to baseline (T1).

$H_{4a\text{-}HR}$ is accepted as there was no statistically significant decrease in heart rate within the control group at the measurement at T2 when compared to baseline (T1). Likewise, $H_{4b\text{-}HR}$ is accepted as there was no statistically significant decrease in heart rate within the control group at the measurement at T3 when compared to baseline (T1).

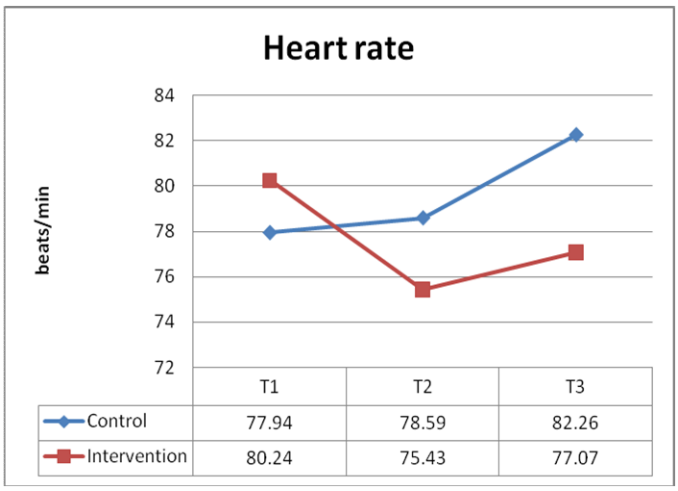

Figure 4-3. Mean heart rate (HR) in the control group and the intervention group at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Table 4-9

Least Squares Means heart rate (HR) in the control group (1) and the intervention group (2) at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Group	time	Estimate Mean	Standard Error	DF	t Value	Pr > | t |	Lower	Upper
1	1	77.94	2.26	59	34.49	<.0001	73.42	82.47
1	2	78.59	2.26	59	34.78	<.0001	74.07	83.12
1	3	82.24	2.26	59	36.39	<.0001	77.71	86.76
2	1	80.24	2.14	59	37.54	<.0001	75.96	84.51
2	2	75.43	2.41	59	31.36	<.0001	70.62	80.25
2	3	77.07	2.49	59	30.95	<.0001	72.09	82.05

Table 4-10

Difference in mean heart rate (HR) between groups at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	2	1	-2.30	3.11	59	-0.74	0.4634	-8.52	3.93
1	2	2	2	2.03	2.49	28	0.81	0.4223	-3.08	7.14
1	3	2	3	5.56	0.50	28	2.22	0.0344*	0.44	10.68

group 1 = control, group 2 = intervention, *p < .05

Table 4-11

Difference in mean heart rate (HR) within group

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	1	2	-0.65	3.20	59	-0.20	0.8402	7.04	5.75
1	1	1	3	-4.29	3.20	59	-1.34	0.1842	-10.69	2.10
1	2	1	3	-5.11	2.41	28	-2.12	0.0434*	-10.05	-0.16
2	1	2	2	4.80	3.22	59	1.49	0.1409	-1.64	11.24
2	1	2	3	3.17	3.28	59	0.96	0.3387	-3.40	9.73
2	2	2	3	-1.58	2.57	28	-0.61	0.5448	-6.85	3.69

group 1 = control, group 2 = intervention, *p < .05

4) Respiratory rate (RR)

The changes in mean respiratory rate (RR) between the intervention and the control groups were assessed at baseline (T1), immediately after the intervention completion (T2), and at one-month follow-up (T3). Figure 4-4 and Table 4-12 demonstrate the mean respiratory rate of the intervention and control groups by time. Results in between- and within-group comparisons at baseline, immediately after the

intervention completion, and at one-month follow-up are displayed in Table 4-13 and Table 4-14 respectively.

Between-group comparisons by time. There was a statistically significant difference in mean respiratory rate between the intervention and control groups at immediately after the intervention completion and at one-month follow-up. Mean respiratory rate of the intervention group was statistically significant lower than that of the control group immediately after the intervention completion and at one-month follow-up ($p < .05$, $p < .01$ respectively). There were no statistically significant differences in mean respiratory rate between the two groups at baseline (Table 4-13).

Within-group comparisons by time. There was no statistically significant decrease in respiratory rate within either the intervention group or the control group at the intervention completion and at one-month follow-up from baseline (Table 4-14).

Thus, for respiratory rate, $H_{1\text{-}RR}$ is accepted as there is no statistically significant difference in the respiratory rate of the intervention group and those in the control group at the baseline measurement.

$H_{2a\text{-}RR}$ is accepted as the intervention group had a statistically significant decrease in respiratory rate when compared to the control group at the measurement immediately after the intervention completion (T2). $H_{2b\text{-}RR}$ is accepted as the intervention group had a statistically significant decrease in respiratory rate when compared to the control group one-month follow-up (T3).

$H_{3a\text{-}RR}$ is rejected as there was no statistically significant decrease in respiratory rate within the intervention group at the measurement immediately after the intervention completion (T2) when compared to baseline (T1). Similarly, $H_{3b\text{-}RR}$ is rejected as there

was no statistically significant decrease in respiratory rate within the intervention group at one-month follow-up (T3) when compared to baseline (T1).

$H_{4a\text{-}RR}$ is accepted as there was no statistically significant decrease in respiratory rate within the control group at the measurement at T2 when compared to baseline (T1). Likewise, $H_{4b\text{-}RR}$ is accepted as there was no statistically significant decrease in respiratory rate within the control group at the measurement at T3 when compared to baseline (T1).

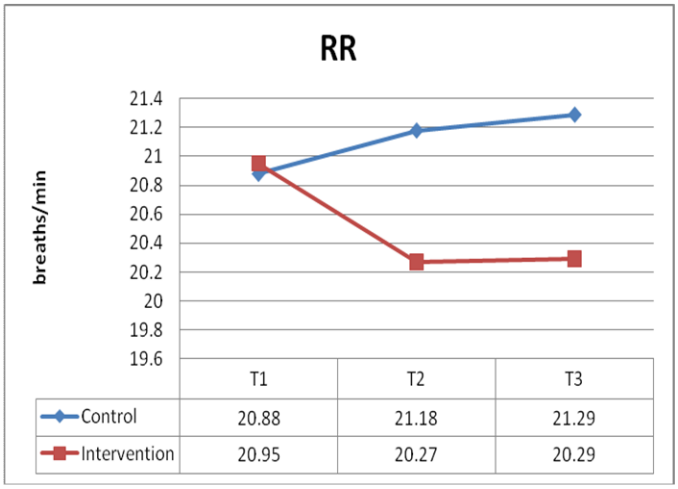

Figure 4-4. Mean respiratory rate (RR) in the control group and the intervention group at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Table 4-12

Least Squares Means respiratory rate (RR) in the control group (1) and the intervention group (2) at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Group	time	Estimate Mean	Standard Error	DF	t Value	Pr > | t |	Lower	Upper
1	1	20.88	0.34	59	61.80	<.0001	20.21	21.56
1	2	21.18	0.34	59	62.67	<.0001	20.50	21.85
1	3	21.29	0.34	59	63.02	<.0001	20.62	21.97
2	1	20.95	0.32	59	65.54	<.0001	20.31	21.59
2	2	20.27	0.36	59	56.34	<.0001	19.55	20.99
2	3	20.29	0.37	59	54.48	<.0001	19.54	21.03

Table 4-13

Difference in mean respiratory rate (RR) between groups at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	2	1	-0.07	0.46	59	-0.14	0.8893	-0.99	0.87
1	2	2	2	0.59	0.26	28	2.25	0.0322*	0.05	1.13
1	3	2	3	0.92	0.27	28	3.40	0.0021**	0.37	1.47

group 1 = control, group 2 = intervention, *p < .05, **p < .01

Table 4-14

Difference in mean respiratory rate (RR) within group

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	1	2	-0.29	0.48	59	-0.62	0.5406	-1.25	0.66
1	1	1	3	-0.41	0.48	59	-0.86	0.3923	-1.37	0.54
1	2	1	3	-0.33	0.26	28	-1.27	0.2160	-0.85	0.20
2	1	2	2	0.68	0.48	59	1.41	0.1624	-0.28	1.64
2	1	2	3	0.66	0.49	59	1.35	0.1827	-0.32	1.64
2	2	2	3	-0.00	0.27	28	-0.00	0.9990	-0.56	0.56

group 1 = control, group 2 = intervention

5) Morning Cortisol

Mean morning cortisol between the intervention and the control groups were assessed at baseline (T1), immediately after the intervention completion (T2), and at one-month follow-up (T3). Figure 4-5 and Table 4-15 demonstrate the mean morning cortisol of the intervention and control groups by time. Results in between- and within-group comparisons at baseline, immediately after the intervention completion, and at one-month follow-up are displayed in Table 4-16 and Table 4-17, respectively.

Between-group comparisons by time. There were no statistically significant differences in mean morning cortisol between the intervention and control groups at baseline, immediately after the intervention completion, and at one-month follow-up (Table 4-16).

Within-group comparisons by time. There was a statistically significant decrease in morning cortisol within the intervention group at the intervention completion from baseline ($p < .05$), but not at one-month follow-up. There was no statistically significant

decrease in morning cortisol within the control group at T2 and T3 from baseline (Table 4-17).

Thus, for morning cortisol, $H_{1\text{-AM cor}}$ is accepted as morning cortisol of the intervention group and those in the control group were not significantly difference at the baseline measurement.

$H_{2a\text{- AM cor}}$ is rejected as the intervention group had no statistically significant decrease in morning cortisol when compared to the control group at the measurement immediately after the intervention completion (T2). $H_{2b\text{- AM cor}}$ is rejected as the intervention group had no statistically significant decrease in morning cortisol when compared to the control group one-month follow-up (T3).

$H_{3a\text{- AM cor}}$ is accepted as there was a statistically significant decrease in morning cortisol within the intervention group at the measurement immediately after the intervention completion (T2) when compared to baseline (T1). $H_{3b\text{- AM cor}}$ is rejected as there was no statistically significant decrease in morning cortisol within the intervention group at one-month follow-up (T3) when compared to baseline (T1).

$H_{4a\text{- AM cor}}$ is accepted as there was no statistically significant decrease in morning cortisol within the control group at the T2 measurement when compared to baseline (T1). Likewise, $H_{4b\text{- AM cor}}$ is accepted as there was no statistically significant decrease in morning cortisol within the control group at the T3 measurement when compared to baseline (T1).

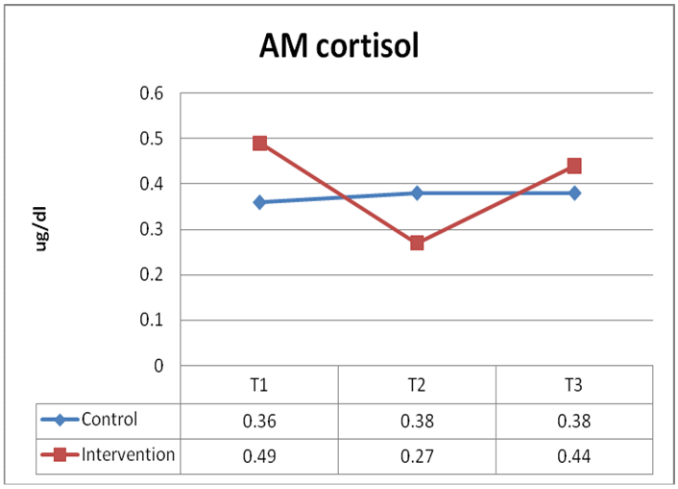

Figure 4-5. Mean morning cortisol in the control group and the intervention group at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Table 4-15

Least Squares Means morning cortisol in the control group (1) and the intervention group (2) at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Group	time	Estimate Mean	Standard Error	DF	t Value	Pr > | t |	Lower	Upper
1	1	0.36	0.07	34	5.20	<.0001	0.22	0.50
1	2	0.38	0.07	34	5.17	<.0001	0.23	0.52
1	3	0.38	0.07	34	5.46	<.0001	0.24	0.52
2	1	0.49	0.07	34	6.74	<.0001	0.34	0.64
2	2	0.27	0.08	34	3.57	0.0011	0.12	0.43
2	3	0.44	0.08	34	5.79	<.0001	0.29	0.60

Table 4-16

Difference in mean morning cortisol between groups at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	2	1	-0.13	0.10	34	-1.29	0.2047	-0.33	0.07
1	2	2	2	0.10	0.11	16	0.96	0.3529	-0.12	0.33
1	3	2	3	-0.09	0.10	16	-0.84	0.4119	-0.31	0.13

group 1 = control, group 2 = intervention

Table 4-17

Difference in mean morning cortisol within group

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	1	2	-0.016	0.10	34	-0.16	0.8765	-0.219	0.188
1	1	1	3	-0.018	0.09	34	-0.18	0.8575	-0.217	0.181
1	2	1	3	-0.005	0.09	16	-0.05	0.9605	-0.210	0.201
2	1	2	2	0.216	0.11	34	2.05	0.0483*	0.002	0.431
2	1	2	3	0.047	0.11	34	0.44	0.6613	-0.168	0.261
2	2	2	3	-0.194	0.11	16	-1.75	0.0996	-0.429	0.041

group 1 = control, group 2 = intervention, *p< .05

6) Afternoon Cortisol (4 PM)

The changes in mean afternoon cortisol between the intervention and the control groups were assessed at baseline (T1), immediately after the intervention completion (T2), and at one-month follow-up (T3). Figure 4-6 and Table 4-18 demonstrate the mean afternoon cortisol of the intervention and control groups by time. Results in between- and

within-group comparisons at baseline, immediately after the intervention completion, and at one-month follow-up are displayed in Table 4-19 and Table 4-20, respectively.

Between-group comparisons by time. There were no statistically significant differences in mean afternoon cortisol between the intervention and the control groups at baseline, immediately after intervention completion, and at one-month follow-up (Table 4-19).

Within-group comparisons by time. There were no statistically significant decreases in afternoon cortisol within either the intervention group or the control group at the intervention completion and one-month follow-up from baseline (Table 4-20).

Thus, for afternoon cortisol, $H_{1\text{-}PM\ cor}$ is accepted as afternoon cortisol of the intervention group and those in the control group were not statistically significantly different at the baseline measurement.

$H_{2a\text{-}\ PM\ cor}$ is rejected as the intervention group had no statistically significant decrease in afternoon cortisol when compared to the control group at the measurement immediately after the intervention completion (T2). $H_{2b\text{-}\ PM\ cor}$ is rejected as the intervention group had no statistically significant decrease in afternoon cortisol when compared to the control group at one-month follow-up (T3).

$H_{3a\text{-}\ PM\ cor}$ is rejected as there was no statistically significant decrease in afternoon cortisol within the intervention group at the measurement immediately after the intervention completion (T2) when compared to baseline (T1). $H_{3b\text{-}\ PM\ cor}$ is rejected as there was no statistically significant decrease in afternoon cortisol within the intervention group at one-month follow-up (T3) when compared to baseline (T1).

$H_{4a\text{- PM cor}}$ is accepted as there was no statistically significant decrease in afternoon cortisol within the control group at the measurement at T2 when compared to baseline (T1). Likewise, $H_{4b\text{- PM cor}}$ is accepted as there is no statistically significant decrease in afternoon cortisol within the control group at the measurement at T3 when compared to baseline (T1).

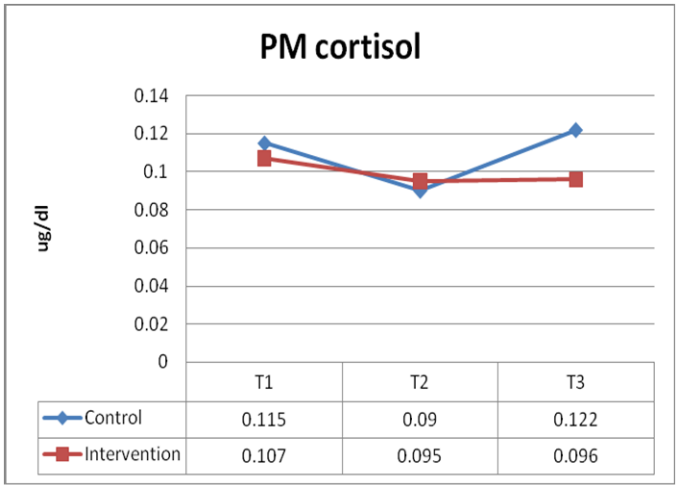

Figure 4-6. Mean afternoon cortisol in the control group and the intervention group at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Table 4-18

Least Squares Means afternoon cortisol in the control group (1) and the intervention group (2) at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Group	time	Estimate Mean	Standard Error	DF	t value	Pr > | t |	Lower	Upper
1	1	0.115	0.02	33	7.28	<.0001	0.08	0.15
1	2	0.090	0.02	33	5.98	<.0001	0.06	0.12
1	3	0.122	0.02	33	8.11	<.0001	0.09	0.15
2	1	0.107	0.02	33	6.75	<.0001	0.07	0.14
2	2	0.095	0.02	33	5.40	<.0001	0.06	0.13
2	3	0.096	0.02	33	5.46	<.0001	0.06	0.13

Table 4-19

Difference in mean afternoon cortisol between groups at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	2	1	0.034	0.031	35	1.08	0.2867	-0.029	0.097
1	2	2	2	-0.007	0.025	16	-0.28	0.7864	-0.058	0.045
1	3	2	3	0.024	0.025	16	0.99	0.3384	-0.028	0.076

group 1 = control, group 2 = intervention

Table 4-20

Difference in mean afternoon cortisol within group

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	1	2	0.025	0.022	33	1.14	0.2605	-0.019	0.069
1	1	1	3	-0.007	0.022	33	-0.33	0.7447	-0.052	0.037
1	2	1	3	-0.032	0.022	16	-1.45	0.1670	-0.079	0.015
2	1	2	2	0.011	0.024	33	0.48	0.6361	-0.037	0.059
2	1	2	3	0.010	0.024	33	0.43	0.6699	-0.038	0.058
2	2	2	3	-0.001	0.026	16	-0.05	0.9640	-0.056	0.054

group 1 = control, group 2 = intervention

Psychological outcome variables

7) Mood disturbance

The changes in mood disturbance scores between the intervention and the control groups were assessed at baseline (T1), immediately after the intervention completion (T2), and at one-month follow-up (T3). Figure 4-7 and Table 4-21 demonstrate the mean scores of mood disturbance (POMS) of the intervention and control groups by time. Results in between- and within-group comparisons at baseline, immediately after the intervention completion, and at one-month follow-up are displayed in Table 4-22 and Table 4-23, respectively.

Between-group comparisons by time. There was a statistically significant difference in mood disturbance scores between the intervention and control groups at baseline. Mean scores of mood disturbance in the intervention group were significantly higher than those in the control group at baseline ($p < .05$). There were no statistically significant differences in mood disturbance scores between the two groups at the

measurement immediately after the intervention completion and at one-month follow-up (Table 4-22).

Within-group comparisons by time. There was no statistically significant decrease in mood disturbance scores within either the intervention or the control group. Although there was decrease in mood disturbance scores within the intervention group at the measurement at the intervention completion and at one-month follow-up from baseline, the differences were not statistically significant. However, there were near statistical significance ($p = 0.0562$, 0.0561, respectively) (Table 4-23).

Thus, for mood disturbance, $H_{1\text{-POMS}}$ is rejected as mean mood disturbance scores of the intervention group was statistically significantly higher than those in the control group at the baseline measurement.

$H_{2a\text{- POMS}}$ is rejected as the intervention group had no statistically significant decrease in mood disturbance scores when compared to the control group at the measurement immediately after the intervention completion (T2). $H_{2b\text{- POMS}}$ is rejected as the intervention group had no statistically significant decrease in mood disturbance scores when compared to the control group at one-month follow-up (T3).

$H_{3a\text{- POMS}}$ is rejected as there was no statistically significant decrease in mood disturbance scores within the intervention group at the measurement immediately after the intervention completion (T2) when compared to baseline (T1). $H_{3b\text{- POMS}}$ is rejected as there was no statistically significant decrease in mood disturbance scores within the intervention group at one-month follow-up (T3) when compared to baseline (T1).

$H_{4a\text{- POMS}}$ is accepted as there was no statistically significant decrease in mood disturbance scores within the control group at the measurement at T2 when compared to

baseline (T1). Likewise, $H_{4b\text{- POMS}}$ is accepted as there was no statistically significant decrease in mood disturbance scores within the control group at the measurement at T3 when compared to baseline (T1).

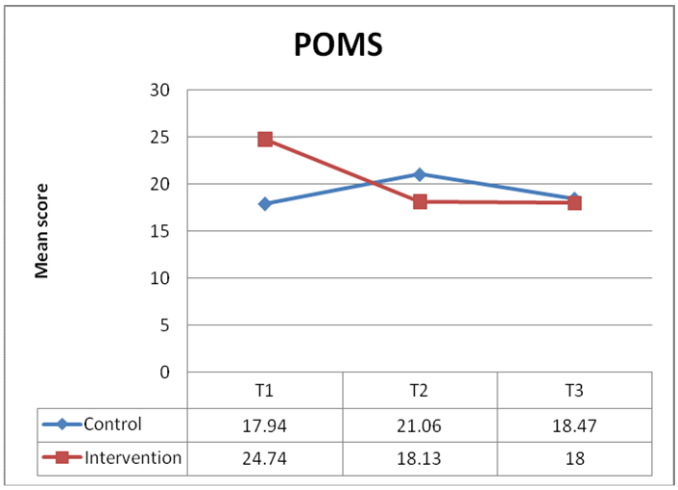

Figure 4-7. Mean mood disturbance scores (POMS) in the control group and the intervention group at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Table 4-21

Least Squares Means mood disturbance scores of the control group (1) and the intervention group (2) at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Group	time	Estimate Mean	Standard Error	DF	t value	Pr > | t |	Lower	Upper
1	1	17.94	2.38	59	7.54	<.0001	13.18	22.70
1	2	21.06	2.38	59	8.85	<.0001	16.29	25.82
1	3	18.47	2.38	59	7.76	<.0001	13.71	23.23
2	1	24.74	2.25	59	10.99	<.0001	20.23	29.24
2	2	18.13	2.53	59	7.16	<.0001	13.06	23.20
2	3	18.00	2.62	59	6.86	<.0001	12.75	23.25

Table 4-22

Difference in mean mood disturbance scores between groups at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	2	1	-6.79	3.28	59	-2.07	0.0424*	-13.35	-0.24
1	2	2	2	5.09	2.80	29	1.82	0.0791	-0.63	10.82
1	3	2	3	2.67	2.85	29	0.94	0.3567	-3.16	8.50

group1 = control, group 2 = intervention, *p < .05

Table 4-23

Difference in mean mood disturbance scores within group

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	1	2	-3.12	3.37	59	-0.93	0.3581	-9.85	3.62
1	1	1	3	-0.53	3.37	59	-0.16	0.8756	-7.26	6.21
1	2	1	3	0.73	2.34	28	0.31	0.7555	-4.05	5.52
2	1	2	2	6.60	3.39	59	1.95	0.0562	-0.18	13.39
2	1	2	3	6.74	3.46	59	1.95	0.0561	-0.18	13.65
2	2	2	3	0.16	2.49	28	0.06	0.9487	-4.94	5.27

group 1 = control, group 2 = intervention

8) Symptoms of Stress (C-SOSI)

The changes in scores of symptoms of stress between the intervention and the control groups were assessed at baseline (T1), immediately after the intervention completion (T2), and at one-month follow-up (T3). Figure 4-8 and Table 4-24 demonstrate the mean scores in symptoms of stress (C-SOSI) of the intervention and control groups by time. Results in between- and within-group comparisons at baseline, immediately after the intervention completion, and at one-month follow-up are displayed in Table 4-25 and Table 4-26, respectively.

Between-group comparisons by time. There were no statistically significant differences in scores in symptoms of stress between the two groups at either baseline, immediately after the intervention completion, or at one-month follow-up (Table 4-25).

Within-group comparisons by time. There were no statistically significant decreases in scores in symptoms of stress within either the intervention group or the control group from baseline (Table 4-26). Mean scores of symptoms of stress in the intervention group were lower at the measurement at immediately after the intervention

completion and at one-month follow-up, as compared to baseline. However, the differences were not statistically significant ($p = 0.0809$, 0.0957, respectively) (Table 4-26).

Thus, for symptoms of stress, $H_{1\text{-}C\text{-}SOSI}$ is accepted as scores of symptoms of stress of the intervention group and those in the control group were not statistically significantly different at the baseline measurement.

$H_{2a\text{-}C\text{-}SOSI}$ is rejected as the intervention group had no statistically significant decrease in scores of symptoms of stress when compared to the control group at the measurement immediately after the intervention completion (T2). $H_{2b\text{-}C\text{-}SOSI}$ is rejected as the intervention group had no statistically significant decrease in scores of symptoms of stress when compared to the control group at one-month follow-up (T3).

$H_{3a\text{-}C\text{-}SOSI}$ is rejected as there was no statistically significant decrease in scores of symptoms of stress within the intervention group at the measurement immediately after the intervention completion (T2) when compared to baseline (T1). $H_{3b\text{-}C\text{-}SOSI}$ is rejected as there was no statistically significant decrease in scores of symptoms of stress within the intervention group at one-month follow-up (T3) when compared to baseline (T1).

$H_{4a\text{-}C\text{-}SOSI}$ is accepted as there was no statistically significant decrease in scores of symptoms of stress within the control group at the measurement at T2 when compared to baseline (T1). Likewise, $H_{4b\text{-}C\text{-}SOSI}$ is accepted as there was no statistically significant decrease in scores of symptoms of stress within the control group at the measurement at T3 when compared to baseline (T1).

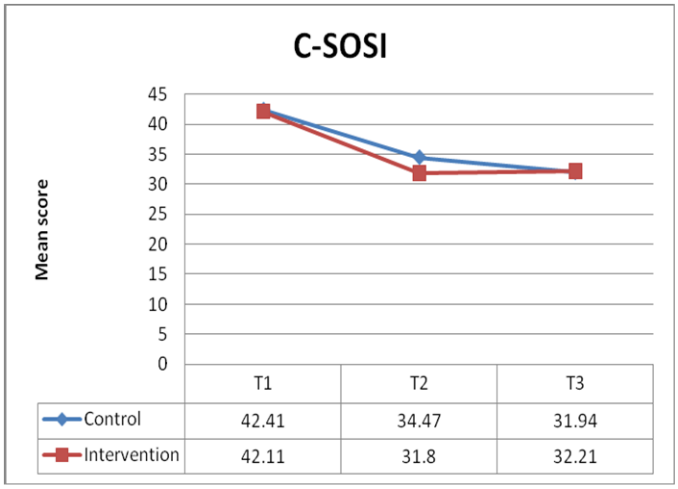

Figure 4-8. Mean symptoms of stress scores (C-SOSI) in the control group and the intervention group at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Table 4-24

Least Squares Means symptoms of stress scores (C-SOSI) in the control group (1) and the intervention group (2) at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Group	time	Estimate Mean	Standard Error	DF	t Value	Pr > | t |	Lower	Upper
1	1	42.41	5.24	57	8.10	<.0001	31.93	52.89
1	2	34.47	5.24	57	6.58	<.0001	23.99	44.95
1	3	31.94	5.39	57	5.92	<.0001	21.13	42.74
2	1	42.11	5.09	57	8.28	<.0001	31.92	52.30
2	2	31.80	5.57	57	5.71	<.0001	20.64	42.96
2	3	32.21	5.77	57	5.58	<.0001	20.66	43.77

Table 4-25

Difference in mean symptoms of stress scores (C-SOSI) between groups at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	2	1	-4.43	8.19	59	-0.54	0.5905	-20.81	11.95
1	2	2	2	1.67	5.06	29	0.33	0.7441	-8.69	12.03
1	3	2	3	3.61	5.16	29	0.70	0.4895	-6.94	14.16

group 1 = control, group 2 = intervention

Table 4-26

Difference in mean symptoms of stress scores (C-SOSI) within group

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	1	2	7.94	8.41	59	0.94	0.3490	-8.89	24.77
1	1	1	3	5.82	8.41	59	0.69	0.4915	-11.01	22.66
1	2	1	3	-2.12	4.90	29	-0.43	0.6690	-12.14	7.91
2	1	2	2	15.04	8.47	59	1.78	0.0809	-1.91	31.99
2	1	2	3	14.63	8.64	59	1.69	0.0957	-2.66	31.91
2	2	2	3	-0.18	5.31	29	-0.03	0.9739	-11.04	10.69

group 1 = control, group 2 = intervention

9) Mindfulness State

The changes in mindfulness scores between the intervention and the control groups were assessed at baseline (T1), immediately after the intervention completion (T2), and at one-month follow-up (T3). Figure 4-9 and Table 4-27 demonstrate the mean scores in mindfulness state (FFMQ) in the intervention and control groups by time.

Results in between- and within-group comparisons at baseline, immediately after the intervention completion, and at one-month follow-up are displayed in Table 4-28 and Table 4-29, respectively.

Between-group comparisons by time. Mean scores in mindfulness state of the intervention group were statistically significantly higher than those in the control group at the intervention completion and at one-month follow-up ($p < .05$, $p \leq .001$, respectively). There were no statistically significant differences in mean scores in mindfulness state between the two groups at baseline (Table 4-28).

Within-group comparisons by time. There were statistically significant increase in mindfulness state scores within the intervention group at the intervention completion and at one-month follow-up from baseline ($p < .05$; $p < .01$, respectively). There was no statistically significant increase in mindfulness state scores within the control group from baseline (Table 4-29).

Thus, for mindfulness state, $H_{1\text{-}FFMQ}$ is accepted as mindfulness state scores of the intervention group and those in the control group were not statistically significantly different at the baseline measurement.

$H_{2a\text{-}FFMQ}$ is accepted as the intervention group had a statistically significant increase in mindfulness states scores when compared to the control group at the measurement immediately after the intervention completion (T2). Similarly, $H_{2b\text{-}FFMQ}$ is accepted as the intervention group had a statistically significant increase in mindfulness state scores when compared to the control group at one-month follow-up (T3).

$H_{3a\text{-}FFMQ}$ is accepted as there was a statistically significant increase in mindfulness state scores within the intervention group at the measurement immediately

after the intervention completion (T2) when compared to baseline (T1). Similarly, $H_{3b\text{-}FFMQ}$ is accepted as there was a statistically significant increase in mindfulness state scores within the intervention group at one-month follow-up (T3) when compared to baseline (T1).

$H_{4a\text{-}FFMQ}$ is accepted as there was no statistically significant increase in mindfulness state scores within the control group at the measurement at T2 when compared to baseline (T1). Likewise, $H_{4b\text{-}FFMQ}$ is accepted as there was no statistically significant increase in mindfulness state scores within the control group at the measurement at T3 when compared to baseline (T1).

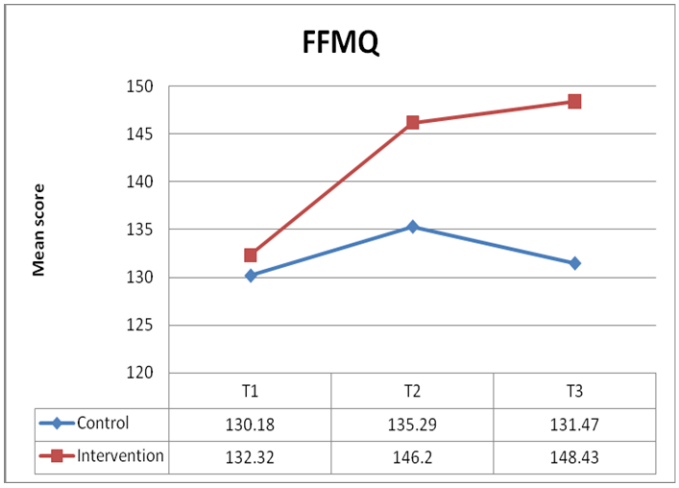

Figure 4-9. Mean mindfulness state scores (FFMQ) in the control group and the intervention group at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Table 4-27

Least Squares Means mindfulness state scores (FFMQ) in the control group (1) and the intervention group (2) at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

Group	time	Estimate Mean	Standard Error	DF	t value	Pr > | t |	Lower	Upper
1	1	130.18	4.80	59	27.11	<.0001	120.57	139.78
1	2	135.29	4.80	59	28.18	<.0001	25.69	144.90
1	3	131.47	4.80	59	27.38	<.0001	21.86	141.08
2	1	132.32	4.54	59	29.14	<.0001	23.23	141.40
2	2	146.20	5.11	59	28.60	<.0001	135.97	156.43
2	3	148.43	5.29	59	28.06	<.0001	137.84	159.01

Table 4-28

Difference in mean mindfulness state scores (FFMQ) between groups at baseline (T1), immediately after the MBSR program completion (T2), and one-month follow-up (T3)

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	2	1	-2.14	6.61	59	-0.32	0.7473	-15.36	11.08
1	2	2	2	-7.06	3.28	28	-2.15	0.0405*	-13.79	-0.33
1	3	2	3	-13.63	3.73	29	-3.65	0.0010***	-21.26	-5.99

group 1 = control, group 2 = intervention, *p < .05, ***p ≤.001

Table 4-29

Difference in mean mindfulness state scores (FFMQ) within group

group	time	_group	_time	Estimate difference	Standard Error	DF	t value	p value	Lower	Upper
1	1	1	2	-5.12	6.42	58	-0.80	0.4287	-17.97	7.74
1	1	1	3	-1.29	6.42	58	-0.20	0.8410	-14.15	11.56
1	2	1	3	3.82	3.54	29	1.08	0.2891	-3.42	11.06
2	1	2	2	-13.88	6.47	58	-2.15	0.0360*	-26.83	-0.94
2	1	2	3	-20.92	6.74	58	-3.10	0.0030**	-34.40	-7.43
2	2	2	3	-2.55	3.83	29	-0.66	0.5115	-10.39	5.29

group 1 = control, group 2 = intervention, *p < .05, **p < .01

Summary of quantitative findings

The findings were presented relative to the research questions and hypotheses. The results of quantitative data analyses demonstrated that MBSR was associated with significant improvement in physiological and psychological outcomes in early-stage breast cancer survivors including increased mindfulness state (T2, T3) and reduced high blood pressure (T2, T3), heart rate (T3), and respiratory rate (T2, T3). These changes were statistically significant at p = .05 to p = .001 (Table 4-30). The effects of MBSR on reducing stress in this sample were statistically significant on physiological outcome (morning cortisol) at the measurement immediately after the intervention completion (p = .0483); the change was not sustained as statistically significant at one-month follow-up. MBSR showed a trend toward improving psychological outcomes by reducing mood disturbance (POMS) in this sample, but the change did not meet the statistical significance level at p = .05. It was near statistical significance at the p = .05 level.

The summary of each outcome variable in relation to the respective hypotheses is presented in Table 4-31. For systolic blood pressure, H_1, H_{2a} are rejected, whereas H_{2b} is accepted; H_{3a} and H_{3b} are rejected. H_{2a} is rejected for diastolic blood pressure, whereas H_1, H_{2b}, H_{3a} and H_{3b} are accepted. For heart rate, H_1 and H_{2b} are accepted, whereas H_{2a}, H_{3a} and H_{3b} are rejected. H_1, H_{2a} and H_{2b} are accepted for respiratory rate, whereas H_{3a} and H_{3b} are rejected. For morning cortisol, H_{2a}, H_{2b}, and H_{3b} are rejected, whereas H_1 and H_{3a} are accepted. H_{2a}, H_{2b}, H_{3a}, and H_{3b} are rejected for afternoon cortisol, whereas H_1 is accepted. H_{2a}, H_{2b}, H_{3a}, and H_{3b} are rejected for mood disturbance (POMS) and symptoms of stress (C-SOSI) whereas H_1 is accepted. H_1, H_{2a}, H_{2b}, H_{3a}, and H_{3b} are accepted for mindfulness state (FFMQ). H_{4a} and H_{4b} are rejected for all outcome variables (Table 4-31).

Table 4-30

Summary of group differences and differences from baseline of each variable

Outcome variables	Group differences			Differences from baseline			
				Intervention group		Control group	
	time 1	time 2	time 3	time 2	time 3	time 2	time 3
SBP	0.0343*	ns	0.0489*	ns	ns	ns	ns
DBP	ns	ns	0.0006***	0.0293*	0.0209*	ns	ns
HR	ns	ns	0.0344*	ns	ns	ns	ns
RR	ns	0.0322*	0.0021**	ns	ns	ns	ns
AM cortisol	ns	ns	ns	0.0483*	ns	ns	ns
PM cortisol	ns	ns	ns	ns	ns	ns	ns
POMS	0.0424*	ns	ns	ns#	ns#	ns	ns
C-SOSI	ns	ns	ns	ns	ns	ns	ns
FFMQ	ns	0.0405*	0.0010***	0.036*	0.003**	ns	ns

*p < .05, **p < .01, ***p ≤ .001, ns = non significant, ns# = borderline

Table 4-31

Summary of each outcome variable in relation to testing hypotheses

	Hypothesis 1	Hypothesis 2		Hypothesis 3		Hypothesis 4	
Variables	H_1	H_{2a}	H_{2b}	H_{3a}	H_{3b}	H_{4a}	H_{4b}
SBP	Re	Re	Accepted	Re	Re	Accepted	Accepted
DBP	Accepted	Re	Accepted	Accepted	Accepted	Accepted	Accepted
HR	Accepted	Re	Accepted	Re	Re	Accepted	Accepted
RR	Accepted	Accepted	Accepted	Re	Re	Accepted	Accepted
AM cortisol	Accepted	Re	Re	Accepted	Re	Accepted	Accepted
PM cortisol	Accepted	Re	Re	Re	Re	Accepted	Accepted
POMS	Re	Re	Re	Re	Re	Accepted	Accepted
C-SOSI	Accepted	Re	Re	Re	Re	Accepted	Accepted
FFMQ	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted	Accepted

Re = rejected

Qualitative Findings

Effects of MBSR as Perceived by Breast Cancer Survivors

The second part of the study used a qualitative method to explore the experience of practicing mindfulness meditation among breast cancer survivors. After the eight-week MBSR program completion, fifteen participants in the intervention group were scheduled for individual in-depth interviews using a semi-structured interview guide. Their experiences and perceptions regarding the benefits they learned from the MBSR class were explored. The following questions were asked to gather qualitative data.

1. Why did you decide to participate in this program?
2. Before participating in the MBSR program, how would you deal with stressors or difficult situations in your daily life?
3. After practicing mindfulness meditation, have you found something has changed in yourself, your life, your ideas, your attitudes, your feeling, and/or your perceptions of your life and others around you?
4. Please explain to me how you used the MBSR to deal with stressors or difficult situation in your daily life.
5. What are aspects of the MBSR program that were most helpful to you?
6. What problems have you experienced in practicing mindfulness meditation?
7. How does practicing mindfulness meditation benefit you?
8. What would you tell other people about the MBSR program?
9. What additional information would you like to share with me about mindfulness meditation?

Results

Subjects

Participants were between 38-71 years in age (average age 56.8 years). Eleven participants were working full-time; four were retired. Thirteen participants were White and two were African-American. Twelve participants were married and three were divorced. Eleven participants had breast cancer stage I; two had stage II; one had stage 0; and one had unknown stage. Nine participants had right-side affected; five had left-side affected; and one had both-sides affected. Participants had been diagnosed between 5 months and 16 years previously (mean, 6.7 years). Numbers of MBSR class attended ranged between 4-8 times (mean, 6.33 times). Nine of fifteen participants (60%) participated in the full-day retreat. Eight participants reported having sleep problems before participating in the study. Signs and symptoms related to stress were reported as anxiety, fatigue, tiredness, having headache, stomach-ache, rapid heart pumping, sleeplessness, high blood pressure, accelerating emotions, tightness, intensiveness in body, muscles and shoulder tightness, and pulling hair.

Data analysis based on interview questions

Reasons for participating in the study

Participants reported reasons for participating in the study as “searching for ways of stress reduction” and “having previous knowledge about benefits of mindfulness meditation.”

Searching for ways of stress reduction. Regarding reasons for deciding to participate in the study, some participants described their lives as very stressful. Their stressors were related to works, families, relationships, and responsibilities. The need to reduce stress influenced them to seek ways for managing and coping. For example, one participant stated, "I have had a lot of stress all of my working life, nearly 20 years. And I raise my three younger siblings pretty much; I have a lot of responsibility. It's hard for me, but I have to do it. So, I tried to find something to take away the stress that I'm going through. That is why I'm here, because I want to reduce my stress." (01, q1)

Another participant who is a nurse practitioner described the reason for participating in the study: "As a nurse practitioner, I have a lot of activities to care for patients. There are a lot of details and I'm very busy all day. So, I don't really have much time to slow down or to minimize stress. I took this class to help me in this way and it does help." (02, q1) One woman had stress regarding her work and family. She told her story: "I was in the transition period. You know, I have to change my work, away from the place that I had been for a long time, more than 20 years. I still don't want to leave. It was difficult for me to learn some new things and it was stressful. I also have trouble with my family. That's why I had a sleep problem. It is like…a lot of things running in my head and I could not stop thinking. I had to take a pill to help me sleep every night; otherwise, I could not get up and go to work. So, that's why I took the class. And I'm glad I did. Now I don't have to take the pill anymore." (04 q1)

One woman has a stressful work situation and has suffered from problem with her health and relationships. She said, "Why I took this class? Because of my stress that

related to my work, my health, and my family. Sometimes if I work at the hospital, I have three appointments. This one may be in this building, but the other one may be in another building. They paged me and I need to get there on time. And sometimes they complain; I have to deal with residents, medical students, nurses, and my boss. And you know, I have breast cancer and my husband left when I was going to receive treatment after we had been married for 20 years. It was very hard and stressful. So, I was looking for something to help me reduce stress." (03, q1)

A 71-year old woman has been stressed for most of her life. She had to take care of her mother who had a chronic illness for nearly 20 years and her third child who became very chronically ill. Her oldest son came back from the service and he was schizophrenic. She has to take care of all of them. She described her life and her need for taking this class: "I had all these things on me and all these people that I have to take care of and so the stress was very heavy. I didn't know how to handle it. I was very busy all the time thinking that, you know, I have to do all these things. It was like counting the clock down and having to be there for everybody but myself. When I heard about this class, I thought that might be something that I really needed to do. And it was, because it changed my whole life." (12, q1)

Having previous knowledge about benefits of mindfulness meditation. Another reason why participants decided to participate in the study was described as having previous knowledge about benefits of mindfulness meditation. Some participants had friends who had taken a MBSR class and shared about the benefits of the practice. Some participants have learned about meditation from reading and practiced by themselves.

One woman stated, “I tried to participate because I knew a little bit about mindfulness from a friend who had taken a mindfulness course a year before. He enjoyed that and it worked well for stress reduction.” (02, q1)

The participant who has learned about meditation from a book and practiced by herself shared her interest: “You know, my job is very stressful. I was looking for something to help me. I have been interested in meditation in the past and I bought a book about meditation. I tried to do a little bit by myself, then I got out of it because I wasn’t sure if I did it the right way. So, when the opportunity permits, I thought it might get me back. So, I wanted to come back. That is why I enrolled in this class.” (08, q1) One woman had taken the MBSR class in 2006. She enjoyed the class and wanted to take it again. She expressed: “I have a stressful life. You know, I have stress at work and I have stress at home. That is why I took the MBSR class in 2006. It helped me a lot. So, I wanted to do it again.” (06, q1) Likewise, another woman has heard about the benefits of meditation and yoga. She said, “I have heard that the benefits of meditation and yoga were about decreasing blood pressure, releasing stress, and helping to be more calm. So, I decided to take this class.” (03, q1)

Ways to deal with stress or difficult situations before participating in the study

Ways to deal with stress or difficult situations in daily life before participating in the study were reported as: keeping busy, prayer, taking sleep medicine, talking with friends, exercise, and doing pleasant things.

One woman described that when she was stressed, she tried to work more to keep her mind busy and not think about it. She stated, "When I was stressed, I tried to work more on something. For example, when my grandmother died, I tried to work more on cooking and cleaning because I didn't know what to do. So, I just did something that made me busy and didn't think more about it." (01, q4) Another woman chose to do some pleasant things to keep her mind busy when she was stressed. She described, "Probably, I try to relax by doing things that were more pleasant like taking an evening walk, watching television, or doing something that keeps my mind from not thinking about what is going on in my mind." (14, q4)

One woman used to pray when she was stressed. She said, "Before I took the class, I used to pray when I am very stressed or have a difficult time. I think it made me feel better." (03, q4) One woman had sleeping difficulty when she was stressed. She described the ways she used to deal with it, "When I was stressed, I had a sleeping problem. If I couldn't sleep at night, I took Ambien (sleep medicine). You know, I took it, for a while, every night because I knew I could not sleep. If I didn't take it before I went to bed, and then I couldn't sleep, I might have to get up to do something, like working on the computer, playing games or something until I was tired. Then I went back to bed. I always got like 3-4 hours for sleep and it was not enough. Sometimes I drink a glass of milk; it helps me just a little." (04, q4)

One woman used to talk with friends when she was stressed, but did not find this very helpful. She said, "You know, I used to like…talking with friends about the stressful events. Probably not helpful. I mean it is good if you have friends who are willing to hear

about your problems. However, that may be only a short time and then you may lose your friends because no one wants to hear bad situations all the time. So, you know, this is why mindfulness is quite good and useable." (06, q4)

Exercise was also used as ways to deal with stress. One woman stated, "When I get frustrated or angry, I do a lot of swimming. Whenever I feel very stressful, I go to swim. Then I can come back feeling better. I can handle the situation better." (07, q4) Another woman who used to exercise after work to help her reduce stress expressed, "I exercised after work. I didn't get home because I did a lot of exercise to help me release stress. Then I got home so late and too late for supper. So, my eating wasn't good. I used to pick some protein dinner or something like that." (13, q4)

Pleasant experience

When asking about a pleasant experience during practice, most participants reported their favorite or pleasant experience in terms of having very special and prefered feelings. These experiences were described as "*being really relaxed,*" "*having a sense of peace,*" and "*putting everything aside*."

Being really relaxed. Pleasant experiences that most participants had during practice were reported as "being really relaxed." One woman favored doing the body scan very much. She described her pleasant experience, "You know, doing the body scan is really relaxing, I feel like falling asleep. It helps me to much more relax my mind. I love it. It is very nice. I didn't want to get up off the floor or do anything." (02, q6) Another participant who always had general muscle tension when she was stressed stated,

"It's really relaxing. My face, my shoulders, and all of my muscles don't tense anymore. Normally, all of my muscles are very tense when I'm stressful. Also my jaw will stay open when I yawn too high, if I'm stressed. My dentist told me to watch and take care of it. I have some problem with the jaw joint. When I'm relaxed, it is fine." (04, q6) Another participant had a similar pleasant experience. She expressed, "I feel very light when I close my eyes and focus on my breathing. And I like that feeling very much. Also when I'm doing yoga, my muscles are very flexible. I am able to do more things that I wasn't able to do before." (03, q6)

One woman was really grateful to share the pleasant experience she had during practice. She expressed, "There were times that I would sit there and really felt like I was just floating out of my body. I was really relaxed. Even though I felt like I was just having an out-of-body experience, I was still aware of what I was doing and whatever. It was just so pleasant to me. I could just simply relax and you know, I thought why is this something so simple that I didn't have it sooner in my life." (12, q6)

Having a sense of peace. Having a sense of peace was described as a person feels safe, peaceful, restful, appreciative and getting in touch with the environment as a whole. One woman expressed her pleasant experience in this way, "While meditating, a lot of times, I feel like I am sleepy, but I am conscious about everything that is going on around. That was very pleasant. And the deep breathing relaxation when you were done, it is very pleasant. I feel animated, peaceful, and restful. The most important thing is having a sense of peace that means you are surrounding and appreciating what you are and everything around you." (08, q6)

Putting everything aside. A pleasant experience during practicing was also described as *putting everything aside* or *turning off anxiety*. One woman shared her pleasant experience during practice as, "To me, it is like a way of totally turning off my anxiety. You know, even though nothing has changed about whatever the problem is….that probably caused me to worry or to get upset. To employ the practice, it is very relaxing; it like a way of turning off being upset. It helps me control my reaction to the things causing me to be upset." (06, q6) Likewise, another woman had a similar pleasant experience, she expressed, "It helps you kind of stop your worry, your anxiety, and put everything aside which is very pleasant. You know, at the end of the day, it just helps you kind of regroup mentally and then go to sleep. I think it's really helpful." (11, q6)

Unpleasant experience

In addition to pleasant experiences that everybody had, four participants reported some unpleasant experiences they had during the practice. One woman had difficulty in doing some yoga positions. She said, "I could not do some yoga positions because it hurts my back. Especially, when I lie on the floor, if I didn't use pillows for support, it hurts my lower back. I also have problem with my balance while doing some postures. So, I have to choose some positions that I can do." (04, q7)

Another woman experienced pain in her shoulder during sitting meditation. She expressed, "Sometimes I got pain in my shoulder during sitting meditation. It didn't bother me during other tools. That is why I didn't do much sitting. I did try to focus on the pain, but wasn't successful." (09, q7) Likewise, another participant had difficulty with sitting meditation. She stated, "The sitting one I kind of had the hardest time with. It

just always seemed really long to me to just sit and keep my mind just focused at the center." (11, q7)

One woman explained that she had difficulty to bring the mind back when doing sitting meditation. For her, sometimes she found allowing the mind to wander was more favorable. She expressed, "The difficult thing with me is the idea that you have to bring your mind back; you should not let it wander. To me, sometimes when the mind wanders, it is a pleasant experience. You know, sometimes I enjoy what the mind does, just like fantastic stories, and kind of relax." (14, q7)

Change after taking the MBSR class

Participants were asked if they observed something change with themselves after taking the MBSR class. The main objective was to explore how participants applied what they had learned from class in their daily life and what they found practical and beneficial. The change might relate to their ideas, their attitudes, and their feelings about themselves and others, as well as their behaviors and reactions to situations and other people. Five themes were reported as changes resulting from implementing meditational techniques in their daily lives. These themes included: "*reducing stress," "being more aware," "being more accepting," "being refreshed and having more energy,"* and *"having a whole life change."*

Reducing stress. The majority of participants described the change after participating in the MBSR class and addressing some meditational techniques in their daily life as reducing stress. One participant described her change as, "It's good. It helps

me a lot with my stress reduction. I mean I feel very good when I went to class and did the practice. This kind of thing reminds me that I can calm down with the practice." (01, q10) Likewise, another participant who had been stressed and taken sleep medicine for a long time expressed, "After taking the class, it like reduced things that are running in my head and I feel better. I haven't had to take the Ambien (sleep medicine) anymore. You know, I'm going pretty much right to sleep. If I wake up or I go to the rest room, when I go back to bed, I haven't had any trouble falling to sleep. I just lie down and breathe. So, I haven't had trouble sleeping and I haven't had to take sleep medicine at all after I had been taking it for a year." (04, q 10)

One participant had a lot of anxiety. She explained the effect of MBSR (for her) as "*turning off anxiety*". She said, "You know, I'm a person who has a lot of anxiety. Sometime when I worry, I scratch my skin and I get anxious. That is a part of my reaction. So, the knowledge and technique of the MBSR are very helpful and stopped me doing something like that. It's like… turning off my anxiety. It is very good! That is why I want to continue doing this." (06, q10) Likewise, another woman shared the benefit she had from MBSR, "To me, I think the meditation allows me to get out of the stress. It's kind of I can let it go; I don't have to keep it in my mind anymore." (14, q10)

Being more aware. The change after participating in the MBSR class was also reported as "*being more aware."* Nearly all participants noticed the change in this way, but used different words for describing it, such as "being more mindful," "slowing down, and "being more in control." One woman noticed the change with herself as paying more attention to her health. She stated, "During the few weeks that I took the class, I felt more

aware. I ate more healthy food and paid more attention to my health. I quit drinking coffee. You know, I used to drink coffee two pots a day." (01, q10)

Another woman who was very busy at work and always doing things automatically observed the change with herself as being more aware. She expressed, "I think I pay more attention when I'm listening, being a better listener. It makes me more aware with myself. That was the big thing I got from the class. You know, I was a busy nurse and kind of automatically doing things, not always thinking about what I was doing." (02, q10) One participant was very proud to share that she lost 15 pounds regarding being in more control of her eating behavior. She said, "After I took the class, I have more control about my eating because I am more conscious of what I put into my body. And one thing that I am more careful of now is selecting things to drink. I always choose sugar-free or no-sugar-added. And you know I have lost 15 pounds within two months." (03, q10)

One participant noticed her change as slowing down in reaction to others. She stated, "After taking the class, I think I'm slowing down with my reaction with others. And it is good, especially with my husband, if we both act fast, we might fight. I'm not doing things to make people mad. And if I get mad, I feel better sooner." (04, q10) Likewise, another woman saw a change in her reaction to others as to step back and slow down. She expressed, "If people bother me or something, I just step back, don't react to them. The meditation helps me slow down and step back, not panic when things happen anymore. So, integrating the meditation into your life is like having a good friend who will be with you all the time. It is keeping you cool." (07, q10)

Being more accepting. Participants also reported the change in themselves after taking the MBSR class as being more accepting. The idea of being accepting of others and see things as "It is what it is" allows them to enjoy their lives and their work. One participant described the change in herself as, "I think I am enjoying my work and my life more. You know, more accepting of the world as it is happening right now, instead of projecting the past or the future. I like that part and I identify strongly with doing that. Focusing on here and now, I could see the benefit of what happens." (08, q10) Another participant also noticed the change in herself in this way. She stated, "I think after class, I can let a lot of things go and not bother me anymore. I did keep in mind what we were taught in class "It is what it is." I started accepting the change. I know the stress can not be thrown away, but it is okay if you can find the way to cope with it." (09, q10)

Being refreshed and having more energy. One participant reported the change after taking the MBSR class as being more refreshed and having more energy. She described, "What has changed with me? You know, I am more refreshed and have more energy. I feel better. When I'm doing the practice, I feel like energy going to my body, from head to toes and from toes to my head. Now, I am able to do more things after work. Before I took the class, when I got home, I was very exhausted and I had to lie down." (03, q10)

Having a whole life change. One participant incorporated the meditational techniques into her daily life and did meditation nearly all the time. She reported the change in herself as *having a whole life change*. She said, "I am just a different person. I am happier. I feel like I am free from myself. All of that busy-ness in my head caused

anguish. I have allowed it to play a big part in my life, but I am grateful to say that now it's over. Not over for a minute, but for the rest of my life. This has changed my whole being. Now I'm smiling on the outside and the inside. It doesn't mean that I still don't meet stressful situations, but I know how to meet them in a different way. And you know, I was limping with this cane because I didn't want to fall. I would be off balance when I am walking outside. Now, I still might walk with a little limp, but I am able to walk without that cane anymore. My blood pressure also goes down. So, my whole life has changed physically, mentally, and spiritually after taking this class. You know, I think of my life as I am blessed because I have learned something that I can do for the rest of my life. Thank you very much." (12, q10)

Suggestions and recommendations of MBSR for other patients and communities

Participants recommended that the MBSR program is very useful for cancer patients and for others as well. They suggested that the MBSR program should be offered for cancer patients at diagnosis or at the beginning of cancer treatment, especially during chemo therapy.

One woman suggested, "This program should be provided for cancer patients who just got diagnosed. If I had had it, I would appreciate it more. The quietness and the personal meditation that I have learned, work well for me. And totally, I could spend time dealing with breast cancer and in the process of doing that I can let go of other stress from my diagnosis. I think that was very good." (05, q11) Like another woman stated, "When people go through the cancer journey, there is a lot of stress. You know, it would

be very nice to have this program during chemo or after surgery. I think during the chemo would be really helpful." (13, q11)

The recommendation was also given for other people. One woman expressed, "I think the meditation class helps a lot in releasing stress and helps me feel better about myself. I think it is really good for cancer patients and other people to have a class like this. To me, it is amazing that it helps me with my sleep problem. I don't have to take sleep medicine anymore." (04, q11) Another woman said, "I think there is much need for providing the MBSR class for other patients and communities." (02, q11)

One participant suggested that, in addition to its benefits, the meditation has no side effect. She stated, "Meditation and yoga are really helpful for releasing stress. Meditation also helps you to control your thoughts and your mind, and your blood pressure will go down. The most important thing is there is no side effect." (03, q11) Another woman suggested that this program would be good for people who were overweight. She explained, "I think this a perfect program for people who are overweight because they need to be mindful with what they eat, when they eat, and why they eat. They eat for comfort; they eat because they are tired or because they are bored. I also think that meditation is a good program for people who have trouble with their lives." (07, q11)

One woman recommended this program for other groups of patients. She stated, "I think this program should be offered for people with severe stress, they may have huge benefit from the practice. Also for people with other diseases, maybe they could get the benefit too, like those with cardiac disease, or pregnant women." (09, q11)

Suggestions to integrate the MBSR program in the curricula for health professional students

Participants recommended that the MBSR program should be integrated into the curricula for health professional students. They believed this knowledge would be useful for influencing and educating patients.

One participant who is a nurse practitioner suggested, "Being a health care professional, it would be nice to put some lecture about this in the curriculum. You know, I graduated from undergraduate a long time ago and I graduated with my master degree in 1997, but we didn't get any types of information about mindfulness meditation. So, they should add these kinds of things in classes and in curriculum. I do think that as a nurse, we need to get exposed to it. At least we could influence these kinds of things for patients." (02, q12) Likewise, another woman suggested, "I think we need to include a lot more alternative and complementary therapy in curriculum for health science students." (08, q12)

Another woman suggested to add this program in the curricula of nursing students and medical students. She explained, "I think in terms of nursing students and medical students, if you had the training, then you could train your patients who are going through treatment. Even if they didn't take the class, maybe it's probably not practical for someone who's going through treatments to add one more thing like a class once a week. But if you could help your patients by teaching them some of the techniques, I think that would be huge because there's a huge amount of anxiety that comes along with the diagnosis." (11, q12)

Summary of qualitative findings

In summary, most participants reported that they had experienced stressors regarding their work, families, relationships, and responsibilities. The ways they used to deal with stress before participating in the study included: keeping busy, prayer, taking sleep medicine, talking with friends, exercise, and doing pleasant things. Participants decided to participate in the MBSR study based on two main reasons: "*searching for ways of stress reduction*" and "*having previous knowledge about benefits of mindfulness meditation*." All participants reported favorable or pleasant experiences during the practice. These experiences were described as "*being really relaxed,*" "*having a sense of peace,*" and "*putting everything aside*." In addition to pleasant experiences, four participants reported some unpleasant experiences, including difficulty in doing some yoga positions, pain in certain positions, and difficulty in concentrating during sitting meditation. The changes resulting from implementing meditational techniques in their daily lives were reported as: "*reducing stress," "being more aware," "being more accepting," "being refreshed and having more energy,"* and *"having a whole life change."* Participants recommended that the MBSR program should be provided for cancer patients, other groups of patients, and communities, as well. In addition, it was suggested to be integrated into the curricula for health professional students.

CHAPTER FIVE

DISCUSSION

The purposes of this study were to examine effects of Mindfulness-Based Stress Reduction (MBSR) on physiological and psychological outcomes among early-stage breast cancer survivors, and to explore the experience of practicing mindfulness meditation in this sample. Outcome variables included blood pressure (BP), heart rate (HR), respiratory rate (RR), salivary cortisol, mood disturbance, symptoms of stress, and mindfulness state. In this chapter, the findings of each outcome variable are discussed in relation to hypotheses and related literature. Strengths and limitations of the study are identified. Clinical implications, theoretical implications, and recommendations for future studies are suggested.

Discussion of Quantitative Findings

Physiological outcome variables

Blood pressure (BP). The finding in the present study revealed that there was no statistically significant effect of MBSR on systolic blood pressure (SBP) between groups at the measurement immediately after the eight-week MBSR completion. The statistically significant difference in SBP between groups with an average of 10.63 mmHg was found at one-month follow-up (Table 4-4), reflecting that it is possible that MBSR is effective at reducing SBP at one month after MBSR completion in the current study. Presently, no

published study of MBSR with a comparison group that measured BP at intervention completion and at one-month follow-up was found.

For the change within group, the finding in the present study revealed that there was no significant effect of MBSR on SBP within group at the measurement immediately after the eight-week MBSR completion and at one-month follow-up (Table 4-5). This finding is inconsistent with Carlson et al. (2007) who reported SBP decrease with an average of 2, 5.3, and 4.4 mmHg, respectively, at the measurement immediately post eight-week MBSR, six-month follow-up, and one-year follow-up, respectively, among 33 breast and 8 prostate cancer patients.

In the present study, the findings showed there was no significant effect of MBSR on diastolic blood pressure (DBP) between groups at the measurement immediately after the eight-week MBSR completion, but the statistically significant difference with an average of 10.74 mmHg was found at one-month follow-up. It is possible that the effect of MBSR on reducing DBP in the present study is observed at one month after the program completion.

For the change within group, the present study found there was a statistically significant within-group effect of MBSR on reducing DBP at the measurement immediately after the eight-week MBSR completion and at one-month follow-up, with the average decrease of 7.54 mmHg and 8.17 mmHg respectively, from baseline. This finding supported the finding of Carlson et al. (2007) who reported DBP decrease with an average of 1.9, 2.1, and 4.1 mmHg, respectively, at the measurement immediately post MBSR, six-month follow-up, and one-year follow-up, respectively, among 33 breast and

8 prostate cancer patients. This information indicated that the present study showed a greater effect of MBSR on decreasing DBP at the measurement immediately after MBSR completion in this sample than the Carlson et al. study. The finding of the present study is also consistent with Rosenzweig et al. (2007) who reported mean arterial pressure decrease of 6 mmHg (P =.009) at the measurement at one-month follow-up after MBSR completion among adults with type 2 diabetes mellitus.

When compared to other types of meditation in relation to lowered blood pressure, a recent meta-analysis of Transcendental Meditation (TM) reported that regular practice of TM had potential to reduce systolic and diastolic blood pressure by 4.7 and 3.2 mmHg, respectively (Anderson, Liu, & Kryscio, 2008). Effect of TM on lowered blood pressure in adolescents with high normal blood pressure was reported with an average of 6 and 3.6 mmHg, respectively, in resting SBP/DBP, after two months of TM practice (Barnes, Treiber, & Davis, 2001). In a study of Buddhist meditation among Thai college students who practiced intensive meditation for two months, systolic and diastolic blood pressure each decreased with the average of 5 mmHg from baseline (Sudsuang, Chentanez, & Veluvan, 1991).

The effect of MBSR on decreasing blood pressure in the present study is smaller when compared to some studies of TM. For example, Wenneberg et al. (1997) found an average of 9 mmHg DBP decrease in normotensive male volunteers after four months of TM practice. For older African Americans with hypertension, BP decreases were reported with an average of 10/6 mmHg in resting SBP/DBP, after three months of TM intervention (Schneider et al., 1995). The effects of meditation practice on decreasing

blood pressure tended to be greater in studies which implemented longer intervention in samples with hypertension or high normal blood pressure, as above, and when meditation was combined with certain techniques. For example, Manikonda et al. (2005) reported a 11% decrease in SBP in the intervention group receiving contemplative meditation combined with breathing techniques (CMBT) compared to 0% in the control group receiving no intervention. Moreover, it was reported that the effect of MBSR on decreasing BP was found to be less in people who had been living with cancer for a longer period of time (Carlson et al., 2007). Whereas the changes are easier to detect in subjects with high blood pressure, statistically significant differences in BP from pre- to post- MBSR intervention may not be expected to be seen in participants who entered in the study with normal BP.

In summary, the findings in the present study supported the results of previous studies in that MBSR is effective in reducing blood pressure. However, in this study with early-stage breast cancer survivors, the effect of MBSR in reducing blood pressure tended to be significantly different between groups at the measurement one-month after MBSR completion.

Heart rate (HR). The finding in the present study revealed that there was no statistically significant effect of MBSR on heart rate between groups at the measurement immediately after the eight-week MBSR completion. The statistically significant difference in heart rate between groups was found at one-month follow-up (Table 4-10), reflecting that MBSR may be effective at reducing heart rate at one month after MBSR

completion. Presently, no published study of MBSR with a comparison group that measured HR at intervention completion and at one-month follow-up was found.

For within-group, the finding in the present study revealed that there was no significant effect of MBSR on heart rate within groups at the measurement immediately after eight-week MBSR completion and at one-month follow-up (Table 4-11). This finding is inconsistent with Carlson et al. (2007) who reported heart rate decrease with an average of 2.3 beats/ minute from baseline, at the measurement immediately after MBSR completion among 33 breast and 8 prostate cancer patients.

The heart rate significantly decreased between groups at the measurement one-month follow-up in this present study is consistent with the finding of Barnes, Davis, Murzynowski, and Treiber (2004). In their study of MBSR among middle-school students engaged in 10-minute sessions at school and at home after school each day for 3 months, the average heart rate decrease between the intervention and control groups on daytime ambulatory was 5.3 vs. 0.3 beats/ minute, from baseline (Barnes, Davis et al., 2004).

When compared with effects of other types of meditation on decreasing heart rate, a study of four-month Transcendental Meditation (TM) among African-adolescents reported a statistically significant decrease in daytime heart rate between groups across the four visits ($p<.003$) (Barnes, Treiber, & Johnson, 2004). Interestingly, this study found male subjects exhibiting lower daytime and nighttime heart rate, as compared to female subjects. Heart rate decreasing significantly between groups at the one-month follow-up measurement in the present study is also consistent with a study of Buddhist

meditation with Thai college students. The study found heart rate decreased significantly in the intervention group who practiced intensive meditation for two months (Sudsuang et al., 1991). In addition, the finding of MBSR on decreasing heart rate in the present study is similar to the effect of cyclic meditation reported by Patra and Telles (2009). Cyclic meditation which combined yoga postures with periods of supine rest demonstrated effectiveness in decreasing heart rate during the night following daytime cyclic meditation practice (Patra & Telles, 2009).

However, the finding in the present study is in contrast with Travis (2001) who reported no statistically significant difference on heart rate between groups of undergraduate students who had been practicing the TM technique for an average of 5.40 years and the control group.

Respiratory rate (RR). The findings in the present study revealed that there were statistically significant effects of MBSR on reducing respiratory rate between groups with an average of 0.59 breaths per minute at the measurement immediately after the eight-week MBSR completion, and with an average of 0.92 breaths per minute at one-month follow-up (Table 4-13). The changes were statistically significantly different when compared with the control group. For the change within group, the findings in the present study revealed that there was no statistically significant effect of MBSR on reducing respiratory rate within group at the measurement immediately after the eight-week MBSR completion and at one-month follow-up (Table 4-14).

The findings in the present study regarding the effect of MBSR on reducing respiratory rate between groups are consistent with Robert McComb, Tacon, Randolph,

and Caldera (2004) who found a statistically significant difference between groups in respiratory rate among 9 women with documented histories of heart disease who completed an eight-week MBSR, as compared with 9 controls.

Three studies of Transcendental Meditation (TM) found similar findings with the present study. Wallace, Benson, and Wilson (1971) reported minute ventilation decreased about 1 liter/ minute, respiratory rate decreased about three breaths per minute, and oxygen consumption decreased 17% during meditation among 36 TM meditators with experience of TM practice that ranged from 0.25 to 108 months (mean 29.4 months), when compared to the control group. Likewise, a study with 34 experienced TM meditators and 10 non-meditator controls reported that the intervention group demonstrated a significantly decreased respiratory exchange rate during the experimental period (Kesterson & Clinch, 1989). However, these two studies measured respiratory rate during TM practice, whereas the present study performed the measurement after the practice completion. Another study of TM, Travis (2001) reported a statistically significant difference in respiratory rate between undergraduate students who had been practicing the TM technique for an average of 5.4 years and the control group.

When compared with other types of meditation, Kinhin meditation and Zen meditation, the effect of MBSR on decreasing respiratory rate in the present study is much smaller than those two types of meditation. A study of cardiorespiratory synchronization among subjects who had no previous meditation experience reported that, during practicing Zen meditation, the respiratory rate decreased an average of 7.8 breaths per minute from baseline; during practicing Kinhin meditation (MK), the

respiratory rate decreased an average of 10.1breaths per minute from baseline (Cysarz & Bussing, 2005)

Decreased breathing was associated with improved health as it was related with decreased blood pressure. A study evaluated effect of slow breathing on modifying blood pressure in hypertensive subjects, demonstrating that slow breathing reduced blood pressure and enhanced baroreflex sensitivity in hypertensive patients. These effects appear potentially beneficial in the management of hypertension (Joseph et al., 2005).

Cortisol level. In the present study, only morning cortisol significantly decreased within the intervention group at the measurement immediately after the intervention completion, as compared to baseline. No significant changes were seen between groups on morning cortisol (Table 4-16). No significant changes were seen within group in morning cortisol at one-month follow-up and no significant changes were seen in afternoon cortisol, either between or within group, across the study (Tables 4-19, 4-20). The results of the present study are in contrast with Carlson et al. (2007) and Carlson, Speca, Patel, and Goodey (2004) who found that cortisol levels in 33 breast and 8 prostate cancer patients continued to decrease over the follow-up period, and all of the morning, afternoon, and evening, as well as mean cortisol values decreased both from pre- to post-intervention, and also decreased linearly across the year of follow-up.

Likewise, the results of the present study are inconsistent with Witek-Janusek et al. (2008) who reported plasma cortisol significantly decreased in 66 newly diagnosed breast cancer patients at the measurement mid and post MBSR intervention, as well as at one-month follow-up, as compared to baseline. However, in the study of Witek-Janusek

et al. (2008), since participants were new breast cancer cases; the first assessment was performed 10 days after surgery and prior to adjuvant therapy, as well as before the MBSR start-up.

There are three possible reasons that the present study found morning cortisol level within the intervention group significantly decreased only at the measurement immediately after the intervention completion, not at one-month follow-up. Firstly, few participants in the intervention group continued practicing a formal form of MBSR after the program completion. The majority of participants incorporated the three-minute breathing exercise in their daily lives, but did not continue the formal practice which may take about 20 to 30 minutes. Time spent engaging in home practice of formal meditation exercises (body scan, yoga, sitting meditation) was reported to be significantly related to the extent of improvement in most facets of mindfulness and several measures of symptoms and well-being (Carmody & Baer, 2008). The lack of engaging in formal practice after the MBSR program completion in the present study may result in no significant sustained improvement in cortisol level at the one-month follow-up measurement. In the study of Carlson et al. (2007), participants continued to practice formal forms of MBSR. They spent a median time of 7.4 hours/month doing yoga and/or meditating after the end of the MBSR program (about 1/3 yoga, 2/3 meditation). This may lead to the results that their cortisol levels continued to decrease across the study, at six-months and one-year follow-up, as well.

Secondly, participants in the present study were not new cases. They were post diagnosis with breast cancer with an average of 6.73 years. A previous study reported the

most stressful state of women with breast cancer is within the first year after diagnosis (Irvine, Brown, Crooks, Roberts, & Browne, 1991). Thus, it is possible that having the diagnosis of breast cancer for a long period of time allows women in the present study to cope better, resulting in low initial stress levels which led to no statistically significant difference in stress levels from pre- to post-intervention and at one-month follow-up.

Lastly, the present study measured salivary cortisol in a small sample (10-12 subjects in each group). This small sample may lead to less reliability in cortisol levels. In addition, at each measurement time point, the saliva sample was collected only at a single point in the morning and a single point in the evening, as well. A single point sample may not provide accurate values of cortisol levels. Based on the standard guideline for cortisol measurement, the collection of repeated measurements per day over multiple days of testing pre- and post-participation in a MBSR program is suggested in order to obtain a more accurate reflection of cortisol regulation. In addition, repeated measurements within sixty minutes after awakening in the morning is considered a stable and reliable biological marker of adrenocortical activity (Galantino, Baime, Maguire, Szapary, & Farrar, 2005).

In a review of cortisol measurement in MBSR interventions, the authors pointed out that studies which employed a single measure of cortisol failed to find group differences in cortisol levels between controls and participants following an 8-week MBSR program (Matousek, Dobkin, & Pruessner, 2010). This review suggested that the use of a single measure of salivary cortisol is no longer deemed appropriate given the known diurnal rhythmicity and day-to-day variability in cortisol production (Matousek et al., 2010).

In a healthy sample, serum cortisol was reported to be significantly decreased post Buddhist meditation training when compared to an untrained group (Sudsuang et al., 1991). Likewise, traditional Chinese meditation significantly decreased salivary cortisol among college students, as compared to untrained controls (Tang et al., 2007).

The results of the present study are similar to Galantino, Baime, Maguire, Szapary, and Farrar (2005) who reported no statistically significant changes in salivary cortisol levels from pre- to post-intervention in 42 healthcare professionals who completed the eight-week MBSR program. In addition, this study found that correlations between changes in salivary cortisol and psychological measures were weak and not statistically significant (Galantino et al., 2005).

The results of the present study is also consistent with Robinson, Mathews, and Witek-Janusek (2003) who found no statistically significant difference in cortisol levels from pre- to post-intervention in 24 individuals infected with the human immunodeficiency virus (HIV) who completed the eight-week MBSR program, as compared with 10 controls. Moreover, the results of the present study are similar to Robert-McComb, Tacon, Randolph, and Caldera (2004) who reported no statistically significant difference in cortisol levels from pre- to post- eight-week MBSR intervention in 9 women with documented histories of heart disease, as compared with 9 controls. However, the Robert-McComb et al. study did not include the retreat day in the MBSR intervention due to practical restrictions of the participants' schedules. In addition, this study did not discuss time participants spend in home practice. These factors may lead to unclear conclusions in relation to the effect of MBSR. Interestingly, these three studies

(Galantino et al., 2005; Robert-McComb et al., 2004; Robinson et al., 2003) also collected a single spot of cortisol measurement and found no statistically significant difference in cortisol levels between the intervention and control groups.

Further, the findings of the present study are similar to Klatt, Buckworth, and Malarkey (2009) who examined a low-dose MBSR which implemented 6-week MBSR with 22 working adults in comparison to 20 healthy controls. This study reported no statistically significant difference in cortisol levels between the intervention and control groups, although they collected repeated saliva cortisol measures pre- and post-intervention, not a single point measure.

Psychological outcome variables

Mood disturbance (POMS). In the present study, there are no statistically significant differences in mood disturbance scores either between groups or within group (Tables 4-22, 4-23). Mood disturbance scores of the intervention group decreased at the measurement immediately after the intervention completion and at one-month follow-up from baseline, but the changes were not statistically significant at the 0.05 level.

This finding of the present study is consistent with Carlson et al. (2007) who reported no significant difference in mood disturbance scores in 33 breast and 8 prostate cancer patients from pre- to post- MBSR intervention and at six-month follow-up. The finding of the present study is also similar to Carlson, Speca, Patel, and Goodey (2003) who reported no significant changes in any of the mood disturbance (POMS) scores over the course of the eight-week MBSR intervention among 42 breast and prostate cancer

patients. These authors explained that their sample had low initial mood disturbance scores which led to no statistically significant change after the MBSR intervention. In addition, the finding in the present study is consistent with Carlson et al. (2004) who found no statistically significant within-group improvements in mood disturbance (POMS) scores in 42 early-stage breast and prostate cancer patients who completed an eight-week MBSR program. Similarly, in one study in the development of the Mindful Attention Awareness Scale (MAAS), Brown and Ryan (2003) reported no statistically significant within-group improvements in mood disturbance (POMS) scores of 32 early-stage breast and 9 prostate cancer patients who completed an eight-week MBSR program. Moreover, the finding of the present study is similar to Robinson, Mathews, and Witek-Janusek (2003) who reported no statistically significant difference in mood disturbance (POMS) scores from pre- to post-intervention in 24 individuals infected with the human immunodeficiency virus (HIV) who completed the eight-week MBSR program, as compared with 10 controls.

The finding in the present study is in contrast with several studies which reported a statistically significant decrease in mood disturbance scores from pre- to post- MBSR intervention. For example, Carlson and Garland (2005) found a statistically significant decrease in mood disturbance scores ($p = .001$) in a heterogeneous sample of 63 cancer patients who completed an eight-week MBSR intervention when compared with baseline. In this study, participants had been diagnosed with cancer for a median of 1.1 years. Similarly, Rosenzweig, Reibel, Greeson, Brainard, and Hojat (2003) reported a statistically significant decrease in mood disturbance (POMS) scores among 140 medical students who participated in a ten-week MBSR program, when compared to 162 controls.

Likewise, a study of an eight-week MBSR with 47 cancer patients reported a statistically significant decrease in mood disturbance (POMS) scores from pre- to post-intervention (Kieviet-Stijnen, Visser, Garssen, & Hudig, 2008). In this study, half of participants were within the first year after diagnosis. Further, Galantino et al. (2005) reported a statistically significant decrease in mood disturbance (POMS) scores from pre- to post-MBSR intervention among 84 health-care professionals who completed an eight-week MBSR program. However, this study did not mention the retreat component and time spent in home practice.

In addition, the finding in the present study is inconsistent with a randomized, controlled trial by Speca et al. (2000) who reported a statistically significant decrease in mood disturbance (POMS) scores of 53 patients with heterogeneous type and stage of cancer after completing the seven-week MBSR. Likewise, the finding in the present study is inconsistent with Carlson, Ursuliak, Goodey, Angen, and Speca (2001) who reported a statistically significant within-group decrease in mood disturbance (POMS) scores among 89 patients with heterogeneous type and stage of cancer after completing the seven-week MBSR, and at six-month follow-up. Moreover, Garland, Carlson, Cook, Lansdell, and Speca (2007) reported statistically significant decrease in mood disturbance (POMS) scores in 60 cancer outpatients with a variety of diagnoses who competed an eight-week MBSR program, when compared to 44 controls.

Interestingly, studies conducted with heterogeneous types and stages of cancer tended to find a significant decrease in mood disturbance scores from pre- to post- MBSR intervention.

A possible reason that the present study failed to find a significant difference in mood disturbance (POMS) scores is that participants in the present study had a low mean initial POMS score (mean = 24.74). This score reflected low mood disturbance, as described in the POMS manual. In the previous study, low mood disturbance scores were reported among a sample who had been living with cancer for a period of time, whereas the highest mood disturbance scores in women with breast cancer were found prior to adjuvant therapy (Ah & Kang, 2008).

In the present study, participants had been previously diagnosed with breast cancer an average of 6.73 years earlier. This period of time may allow participants to cope better and have low initial mood disturbance scores. In addition, the majority of participants in the intervention group were university employees and people who have a variety of resources to be accessed. These factors may allow them to cope better when compared with other breast cancer survivors. These reasons may lead them to have low initial mood disturbance scores, resulting in no statistically significant difference in mood disturbance scores after the MBSR intervention.

Symptoms of stress (C-SOSI). In the present study, there are no statistically significant differences in symptoms of stress scores either between groups or within group (Tables 4-25, 4-26). Scores of symptoms of stress of the intervention group decreased at the measurement immediately after the intervention completion and at one-month follow-up, from baseline, but the changes did not reach statistical significance at the 0.05 level.

The finding in the present study is in contrast with several previous studies, as will be discussed. Carlson et al. (2007) reported a statistically significant decrease in

symptoms of stress scores from pre- to post- eight-week MBSR and at six-month and one-year follow-up among 33 breast and 8 prostate cancer patients. In this study, participants had been diagnosed with cancer for a median of 1.1 years previously. Similarly, Carlson, Ursuliak, Goodey, Angen, and Speca (2001) reported a statistically significant decrease in symptoms of stress scores within a group of 89 patients with heterogeneous types and stages of cancer after completing a seven-week MBSR, and at six-month follow-up. In this study, participants had been diagnosed with cancer for an average of 3 years previously. Likewise, Speca et al. (2000) reported a statistically significant decrease of 31% in symptoms of stress reduction within a group of 53 patients with heterogeneous types and stages of cancer after completing a seven-week MBSR. The study of Speca et al. (2000) was conducted with the same sample of Carlson et al. (2001). Participants had been living with cancer for an average of 3 years.

Carlson et al. (2003) reported a statistically significant decrease in symptoms of stress scores ($p < .01$) within a group of 59 early stage breast and prostate cancer patients after completing an eight-week MBSR. In this study, participants had been diagnosed with cancer for a median of 1.1 years previously. This study also pointed out that those having more recent diagnoses, within one year, had significantly higher symptoms of stress scores on the Cognitive Disorganization subscale and a higher mood disturbance score on the Anger subscale than those with longer diagnosis (Carlson et al., 2003). Similarly, Carlson et al. (2004) reported a statistically significant within-group improvement in symptoms of stress scores in 42 early-stage breast and prostate cancer patients who completed an eight-week MBSR program. In this study, participants had been diagnosed with cancer for 1.1 years previously.

Carlson and Garland (2005) found a statistically significant decrease in symptoms of stress scores ($p = .001$) in a heterogeneous sample of 63 cancer patients who completed an eight-week MBSR intervention when compared with baseline. This study did not report time since participants were diagnosed with cancer. Moreover, in their recent study, Garland, Carlson, Cook, Lansdell, and Speca (2007) reported a statistically significant decrease in symptoms of stress scores in 60 cancer outpatients with a variety of diagnoses who completed an eight-week MBSR program, when compared to 44 controls. In this study, participants were living with cancer for approximately 2 years before participating in the study.

This information indicates that the finding in the present study is in contrast with nearly all previous studies which measured symptoms of stress. A possible reason that the present study failed to find a statistically significant difference in symptoms of stress scores from pre- to post- MBSR intervention is participants in the present study had low initial scores of symptoms of stress. Low initial symptoms of stress can be found in persons who had been living with cancer for a long period of time. In the present study, participants had been diagnosed with cancer for an average of 6.73 years. This period of time may allow participants to cope better, resulting in low initial scores of symptoms of stress. As Koopman et al. (2002) reported, symptoms of stress in women with breast cancer presented soon after the women were diagnosed or post surgical treatment. For women who have lived with cancer more than one year, although they may be somewhat stressed, symptoms may not appear. In addition, a high level of traumatic stress symptoms was found on average about six months after the diagnosis of primary breast cancer (Koopman et al., 2002).

Regarding time after diagnosis, participants in all reviewed studies (above) which reported a statistically significant decrease in scores of symptoms of stress after completing an MBSR program had been diagnosed with cancer for a maximum with an average of 3 years, except the study of Carlson and Garland (2005) which did not report time since diagnosis. Taken together, this information indicated that studies with new cases of cancer tend to have higher initial scores of symptoms of stress. Therefore, this group is more likely to show a significant difference in symptoms of stress scores after the MBSR intervention.

Mindfulness state (FFMQ). In this study, mindfulness state scores changed significantly both between groups and within group, as well (Tables 4-28, 4-29). The intervention group has higher mindfulness state scores at the measurement immediately after the intervention completion and at one month follow-up, as compared to baseline. The finding in the present study indicated that mindfulness state resulting from meditation practice is a strong and unique aspect that is still maintained after MBSR program completion.

Four studies found similar findings with the present study. Baer et al. (2008) reported a statistically significant difference in all facets of mindfulness scores in sample which experienced meditation when compared to other groups which included students, community persons, and highly educated persons. This study found the meditators had statistically significant higher scores in all facets of mindfulness state than other groups. Similarly, Carmody and Baer (2008) reported a statistically significant increase in mindfulness scores and well-being and decrease in stress and symptoms in a sample of 174 adults in a clinical Mindfulness-Based Stress Reduction (MBSR) program, from pre-

to post- MBSR. This study suggested that the practice of mindfulness meditation led to increases in mindfulness, which in turn led to symptom reduction and improved well-being.

Lykins and Baer (2009) measured mindfulness in long-term meditators and reported that practicing meditation is associated with increased mindfulness in daily life, which is related to decreased rumination, decreased fear of emotion, and increased behavioral self-regulation. Similarly, Carmody, Baer, and Olendzki (2009) reported a statistically significant improvement in all facets of mindfulness state from pre- to post-MBSR intervention among 278 adults who enrolled in 17 MBSR classes at the University of Massachusetts Medical School's Center for Mindfulness between September 2006 and July 2007.

However, until now, no published studies were identified which measured mindfulness in MBSR intervention at a follow-up measurement.

Discussion of Qualitative Findings

The findings resulted from the analyses of interviews, field notes, and non-participant observation revealed the following. Most participants in the intervention group reported that they had experienced stressors regarding their work, families, relationships, and/or responsibilities. The ways they used to deal with stress before participating in the study included: keeping busy, prayer, taking sleep medicine, talking with friends, exercise, and doing pleasant things. Participants decided to participate in the MBSR study based on two main reasons: "*searching for ways of stress reduction*" and "*having previous knowledge about benefits of mindfulness meditation*." All participants

reported favorable or pleasant experiences during the practice. These experiences were described as "*being really relaxed,*" "*having a sense of peace,*" and "*putting everything aside*." In addition to pleasant experiences, four participants reported some unpleasant experiences, including difficulty in doing some yoga positions, pain in certain positions, and difficulty to concentrate during sitting meditation. The changes resulting from implementing meditational techniques in their daily lives were reported as: "*reducing stress," "being more aware," "being more accepting," "being refreshed and having more energy,"* and *"having a whole life change."* Participants recommended that the MBSR program should be provided for cancer patients, other groups of patients, and communities, as well. In addition, it was suggested to be integrated into the curricula for health professional students.

As noted earlier, few published qualitative studies explored the experience of practicing MBSR. Only one existing qualitative study conducted with oncology patients, including nine participants with different types, stages, and time of cancer diagnosis, was found. The study reported five themes on how MBSR effects change for cancer patients. These themes included: (1) opening to change; (2) self-control; (3) shared experience; (4) personal growth; and (5) spirituality (Mackenzie, Carlson, Munoz, & Speca, 2007). Two themes described were similar to the findings of the present study: "*opening to change*" and "*self-control*" which were described in the present study as "*being more accepting*" and "*being more aware*," respectively.

In the Mackenzie et al. study, "*opening to change*" was described in terms of the way participants thought about and accepted their own illness and the range of ways to

cope with it. The MBSR program was perceived as the entrance to see life from another perspective which allowed participants to search for more information to help in their treatment and recovery. In the present study, "*being more accepting*" was described in terms of the way participants see themselves after taking the MBSR class as being more accepting of themselves and others around them, and seeing things as they are. "*Self-control*" in the Mackenzie et al. study referred to participants' developing ability to control their own behaviors which required them to pay attention to the results of their behaviors and make corrective adjustments as needed. Deeper knowledge and understanding of thoughts and feelings developing from MBSR practice provided more clarity and control which led participants to engage in healthy behaviors. In the present study, "*being more aware*" was described as participants "being more mindful," "slowing down, and "being more in control." They reported paying more attention to and taking care of their health better by not drinking coffee, selecting sugar-free drinks, eating healthy food, and slowing down in reaction to others.

An earlier qualitative study in a healthy sample examining effects of practicing MBSR on self-care and overall well-being reported five themes: (1) promote sense of peace and relaxation, (2) promote health awareness and self-care concern, (3) promote self-management and responsibility, (4) promote sense of giving and sharing, and (5) fulfill a basic need for health and well-being (Matchim, Armer, & Stewart, 2008). Two themes were described which are consistent with the findings in the present study: "promote sense of peace and relaxation" and "promote health awareness and self-care concern" which were described in the present study as "reducing stress" and "being more aware" respectively.

In a qualitative study of older adults with chronic low back pain (CLBP), effects of MBSR were reported in four themes: pain reduction, improved attention, improved sleep, and achieving well-being (Morone, Lynch, Greco, Tindle, & Weiner, 2008). Two themes reported in this study: "*improved attention*" and "*improved sleep*" were described similarly to the findings in the present study. "*Improved attention*" was described similarly to the present study as "*being more aware*." "*Improved sleep*" was also reported in the present study as a result of reducing stress through practicing mindfulness meditation.

These findings indicated that experiences and perceptions of practicing MBSR as perceived by early-stage breast cancer survivors may be somewhat similar to other participants while also representing the unique experiences and perceptions of these survivors.

Conclusions

The study used a mixed-method, quasi-experimental, pre- and post-test control group design with qualitative approaches. The sample consisted of 32 participants, the intervention group (n = 15) and the control group (n = 17). The outcome variables including blood pressure (BP), heart rate (HR), respiratory rate (RR), salivary cortisol, mood disturbance, symptoms of stress, and mindfulness state were measured at baseline, immediately after the intervention completion, and one-month follow-up. The intervention group received the eight-week MBSR program. The control group received no intervention. ANCOVA was used to examine between-group differences at either measurement time point (T2, T3) on each of the seven outcome variables, whereas

ANOVA was used to examine between-group differences at the baseline measurement (T1) on each of the seven variables. A two-factor ANOVA was used to examine whether there were changes from baseline within either group on any of the seven outcome variables. Qualitative data were derived from inept-interview of 15 participants in the intervention group, non-participant observation, and field notes, as well. Qualitative data were analyzed using content analysis.

The results of quantitative analyses demonstrated that MBSR was associated with statistically significant improvement in physiological and psychological outcomes in early-stage breast cancer survivors including increased mindfulness state (T2, T3) and reduced high blood pressure (SBP at T3; DBP at T2, T3), heart rate (T3), and respiratory rate (T3). The effects of MBSR on reducing stress in this sample were statistically significant on the physiological outcome (morning cortisol) at the measurement immediately after the intervention completion, but this effect was not sustained at one-month follow-up. MBSR showed a trend toward improving psychological outcomes by reducing mood disturbance (POMS) in this sample, but the change did not reach statistical significance $p = .05$.

Qualitative findings demonstrated that participants decided to participate in the MBSR study based on two main reasons: "*searching for ways of stress reduction*" and "*having previous knowledge about benefits of mindfulness meditation*." Participants reported predominantly positive experiences with MBSR practice. All participants reported favorable or pleasant experiences during the practice. These experiences were described as "*being really relaxed,*" "*having a sense of peace,*" and "*putting everything aside*." In addition to pleasant experiences, four participants reported some unpleasant

experiences, including difficulty in doing some yoga positions, pain in certain positions, and difficulty in concentrating during sitting meditation. The changes resulting from implementing meditational techniques in their daily lives were reported as: "*reducing stress," "being more aware," "being more accepting," "being refreshed and having more energy,"* and *"having a whole life change."* Participants recommended that the MBSR program should be provided for cancer patients, other groups of patients, and communities, as well. In addition, it was suggested that MBSR be integrated into the curricula for health professional students.

Major findings in the present study were discussed in relation to existing literature. The findings in the present study provide additional knowledge in relation to effects of MBSR on early-stage breast cancer survivors. In addition, the experience of practicing MBSR as perceived by these participants, as well as how early-stage breast cancer survivors find MBSR useful in their daily lives, are addressed. This knowledge may be useful for oncology nurses and other healthcare providers working in this area for better understanding, educating, and motivating their clients.

Clinical Implications

Statistical significance may differ from clinical significance. Statistical significance refers to the likelihood that the difference found between groups could have occurred by chance alone. In most clinical trials, a result is statistically significant if the difference between groups could have occurred by chance alone in less than 1 time in 20; this is expressed as a p value < 0.05 (Jacobson & Truax, 1991). Clinical significance may be associated with the selected outcome criteria to determine if a treatment or intervention is

effective enough to impact patients' diagnoses or treatment. Jacobson and Truax (1991) proposed two components of the index of change clinically: the status of a patient after the intervention completion, and how much change has occurred during the course of the intervention.

Several variables in the present study showed statistically significant differences from pre- to post- intervention, including blood pressure, heart rate, respiratory rate, morning cortisol, and mindfulness state. Some variables such as blood pressure, heart rate, and mindfulness state demonstrated statistical *and* clinical significance. In particular, blood pressure met the criteria for statistical significance displaying between-group difference with an average of 10.63 to 10.74 mmHg and within-group difference with an average of 7.5 to 8.2 mmHg. In addition, mindfulness state showed statistical significance and displayed between-group difference with an average change in score of 7 to 13.6 and within-group difference with an average change in score of 13.8 to 20.92. These changes are associated with clinical significance, as the variance in blood pressure of 7 to 10 mmHg affects diagnosis and treatment decisions. Conversely, some variables such as respiratory rate and morning cortisol (within group at the measurement immediately after the intervention completion) met the test of statistical significance, but did not meet the criteria for clinically significant change. For example, 0.59 to 0.92 breath/ minute change in respiratory rate may not directly be related to a change in health status or treatment decision. On the other hand, the change in symptoms of stress and mood disturbance in this sample could not be detected by tests of statistical significance, but in the qualitative part, participants self-reported in the one-on-one interview that they

were free from stress and the MBSR intervention was diminishing their anxiety. Here, we have an example of clinical significance that is not associated with statistical significance (at the level of $p < 0.05$) using the tools of choice in this study.

As suggested by study participants, MBSR may be a useful program for new cancer patients, especially while receiving chemotherapy or after surgery. Oncology nurses or other healthcare providers working in this area may address implementation of MBSR in clinics. Although in some situations it may be not practical to introduce a whole program, selected mindfulness techniques are still useful. For example, while receiving chemotherapy, patients may be instructed by CDs to focus on their breathing or scan their bodies. These practices may help them to calm their minds and cope with stress better.

In addition, the MBSR program can be applied beyond breast cancer survivors for other groups in clinical settings, such as people with other cancers, obesity, diabetes mellitus, and hypertension. Concepts of developing self-awareness and self-control resulting from practicing meditation may help overweight people to control their eating behaviors and focus more on healthy activities. The ability to control eating behaviors and focus on healthy activities may help people with diabetes mellitus to control their blood sugar, as well. The benefits of reducing stress may be useful for hypertensive people by helping them control their blood pressure which relates to stress. Moreover, this program can be used for communities and workplaces to help people relieve and cope with stress more effectively.

In schools of health sciences, this program (MBSR) should be introduced or integrated into the curriculum. Fundamental knowledge of MBSR should be taught to health sciences students. In health institutions, MBSR workshops should be offered. Each healthcare institution should have experts in this area to be consulted by other health professionals or to be consulted by patients needing more information. In addition, healthcare professionals who have experience or knowledge in this area will be more confident to influence or educate their clients about this program.

Theoretical Implications

The findings in the present study provided evidence to support previous studies that MBSR is a potentially useful program for promoting physiological and psychological health and well-being. The findings in the present study confirm the benefits of MBSR including increased mindfulness state and reduced high blood pressure, heart rate, and respiratory rate in early-stage breast cancer survivors. The effects of MBSR on reducing stress in this sample were statistically significant on physiological outcome (morning cortisol) at the intervention completion, not at one-month follow-up. MBSR showed a trend toward improving psychological outcomes by reducing mood disturbance (POMS) in this sample.

Strengths of the Study

Firstly, the present study has a strong design in using a comparison group and a homogeneous sample. Several previous quantitative studies about mindfulness meditation were criticized due to lack of comparison groups, using non-randomized design, and

samples with heterogeneous types and stages of disease. These factors may lead to problems related to reliability and appropriateness for generalization to breast cancer survivors. The present study was designed to close this gap by using a comparison group homogeneous in type and stage of disease, early-stage breast cancer survivors. Thus, the findings in the present study may be more appropriate for generalization for early-stage breast cancer survivors.

Secondly, the present study used a pre- and post-test design with a baseline measurement. The baseline measurement allows researchers to see the initial status of study participants in relation to variables of interest. In addition to assessing initial status, after intervention completion, baseline data allow researchers to identify the effect size of the intervention by calculating the change from pre- to post- intervention.

Thirdly, the present study incorporated a longitudinal design by conducting a follow-up measurement which can be considered a strength of the study. The follow-up measurement allows researchers to see if the effect of the intervention is strong and can be maintained for a period of time. Especially in studies in the social and behavioral sciences, if the effect of the intervention is not maintained after the intervention completion, this may indicate that the intervention may be not practical for the subjects to apply in their daily lives. On the other hand, if the effect of the intervention is maintained for a period of time after the intervention completion, then the intervention may have more impact and be more practical for the subjects to apply into their daily lives.

Lastly, as mindfulness meditation is a new area of research, especially in nursing, some aspects and mechanisms related to effects of meditation practice are not clearly

documented in the literature review. Using a mixed-method design of quantitative and qualitative approaches to examine and explore the effects of practicing mindfulness meditation in this sample helped us to gain more knowledge and understanding of the phenomena as experienced and perceived by this sample, as well as what they learned from the class and how they found the meditation to be helpful in their daily life.

Limitations of the Study

The first limitation of the present study is the inability to fully apply a randomized design. As noted previously, the present study was designed as a randomized control trial, but due to the fact that breast cancer survivors in Columbia self-selected to participate in the intervention group, randomization was not used. As the MBSR class was offered in Columbia, no one in Columbia wanted to be in the control group; all wanted to participate in the MBSR intervention group. Thus, the study was changed to use a quasi-experimental, pre- and post-test control design. The limitation of the inability to use a randomized control trial may lead to some unavoidable bias. For example, participants who self-selected to participate in the intervention group may be likely to be more concerned about their health. They may take care of their health better than other breast cancer survivors. Thus, the findings from the study may represent this group, specifically, and may therefore limit generalization to other breast cancer survivors.

The second limitation is the fact that salivary cortisol was measured in a small sub-sample without repeated measurements over multiple days. In the present study, salivary cortisol was measured in a small sub-sample (10-12 subjects in each group). This small sub-sample may lead to poor reliability of cortisol levels. In addition, at each

measurement time point, saliva sample was collected only as a single point in the morning and a single point in the evening. This procedure may not provide a reliable cortisol level. To obtain the most accurate value of cortisol level, the standard guideline for cortisol measurement recommended collection of repeated measurements per day over multiple days of testing pre- and post- MBSR program participation (Matousek et al., 2010). In this pilot study, the economic cost of analyzing cortisol levels and modest funding prohibited the research team from carrying out repeated measures per the recommended protocol.

Recommendations for Future Research

Firstly, in the present study, scores of mood disturbance (POMS) and symptoms of stress (C-SOSI) did not show statistically significant differences from baseline. A possible reason for this failure to find significant differences on these measures is that participants in the present study were not newly diagnosed. They had been living with breast cancer for a long period of time (mean = 6.73 years) which may have allowed them to cope better, resulting in low initial scores of POMS and C-SOSI. The low initial scores may have prevented significant changes on these measures. Thus, future research should test these hypotheses with newly diagnosed early-stage breast cancer patients.

Secondly, in this study, salivary cortisol was measured in a small number (10-12 subjects in each group) which may have led to less reliable cortisol levels. In addition, at each measurement time point, the saliva sample was collected only at a single point which may not provide a reliable cortisol level. Thus, future studies should measure cortisol levels in a large sample and follow the standard guidelines for cortisol

measurement which recommended collecting repeated measurements per day over multiple days of testing pre- and post- MBSR intervention with a follow-up measurement, as well.

Thirdly, future researchers who conduct studies with early-stage breast cancer survivors who have been living with cancer for a long period of time should consider using other instruments to measure stress and mood disturbance. The present study used the POMS and C-SOSI to measure stress and mood disturbance and failed to find significant differences in these variables. These instruments may not be sufficiently sensitive to detect a change in this sample. Thus, selecting more sensitive instruments to measure stress and mood disturbance may be more appropriate.

Fourthly, adding one more group as a healthy control is recommended in future research. As the findings of the present study were presented in the previous chapter, the change in some variables in the breast cancer control group was unclear. For example, the changes in SBP, DBP, and HR in the control group which tended to continually increase from T2 to T3. Thus, having a healthy control group to be compared in future research may give more information to explain the change, whether it is a normal phenomenon or a unique change in this sample.

Fifthly, conducting a follow-up measurement at three months after the eight-week MBSR completion is recommended. As noted earlier, conducting repeated measurements allows researchers to check whether the effect of the intervention can be maintained for a period of time after the intervention completion. The ability to maintain the effect of the

intervention may indicate that the intervention is practical for the participants to apply into their daily lives.

Lastly, using a mixed-method design with quantitative and qualitative approaches, in future research is recommended. A mixed-method design seems to be useful in making the findings clearer. Some aspects of the effects of MBSR could not be detected by quantitative measures, but were gathered by qualitative techniques. For example, the present study failed to find statistically significant differences in symptoms of stress and mood disturbance on quantitative measures, but participants reported that they were free from stress, and their anxiety was less. In addition, the effect of MBSR in terms of "being more refreshed and having more energy" as perceived by participants could not be detected by the selected quantitative measure. Thus, using mixed-methods in future research of mindfulness meditation is recommended.

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Appendix A: Summary Tables of Reviewed Studies and Effect Sizes

Appendix A-I: Table 1. Studies of MBSR among breast cancer survivors

Appendix A-II: Table 2. Studies of MBSR with heterogeneous types of cancer in which the predominant cancer was breast cancer

Appendix A-III: Table 3. Effect sizes of MBSR on biological outcomes

Table 1. Studies of MBSR among breast cancer survivors

Study/ Country	Participants	Design	Measures	Effect Size (ES)	Findings
1. Hebert et al., (2001) USA	-157 women with breast cancer (stage I or II)	Randomized clinical trial: NEP/SRC/UC, n = 50/51/56 - follow-up measurement at 1 year	-total energy, -total fat -complex carbohydrate -fiber -body mass -BDI -Self-esteem scale -general symptom checklist -seven day diet recall	*no data for calculating effect size	NEP group experienced a large reduction in fat consumption at 4 months and much of this reduction was preserved at 1 year whereas no change is found in either SRC or UC. A 1.3-kg reduction in body mass was evident at 4 months in the NEP group whereas no change was observed in the SRC and UC group. The SRC group did not receive information about selecting and preparing food. (Psychological outcomes were measured, but did not discuss or report the results).
2. Shapiro et al. (2003) USA	-63 women with breast cancer (stage II)	Randomized, controlled trial: MBSR/FC, n = 31/32	POMS, BDI, PENN, STAI, FACIT-B, SCI, SOC, sleep diary	*no data for calculating effect size	Significant improvement on daily diary sleep quality was found in both MBSR and FC, neither improved on sleep-efficiency. Greater mindfulness practice associated with more sleep quality.
3. Tacon et al. (2004) USA	-27 women with breast cancer	One group pretest-posttest design	-Self-rated stress -STAI -MAC -MHLC	1.657 1.408 0.328 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.
4. Tacon et al. (2005) USA	-30 women with breast cancer	One group pretest-posttest design	-STAI -PF-SOC -MAC	1.360 0.422 0.330	Significant decreases were observed on anxiety, reactive and suppressive coping styles, as well as two scales of mental adjustment: helpless hopelessness and anxious preoccupation.

Study/ Country	Participants	Design	Measures	Effect Size (ES)	Findings
5. Dobkin, (2008) Canada	- 13 women with breast cancer who had completed medical treatment	Mixed method design using quantitative and qualitative approaches	- CES-D - MSCL - PSS - SOC -MAAS -CHIP	0.655 0.904 1.100 0.440 0.562 0.270	Significant 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.
6. Witek-Janusek et al. (2008) USA	- 66 women breast cancer (stage 0-II) self-selected to either MBSR or non-MBSR	Non-randomized control trial: MBSR/non-MBSR/cancer free, n = 38/28/30	- QOL - JCS *optimistic *supportant (reported 2 scales) -MAAS	0.597 0.667 0.807 0.527 (no significant change on MAAS)	MBSR group re-established their immune function, NKCA and cytokine production whereas the non-MBSR group exhibited reductions in NKCA and IFN-c production with increased IL-4, IL-6, and IL-10 production. Moreover, the MBSR group had significant reduced cortisol levels, improved QOL, and increased coping effectiveness.
7. Lengacher et al., (2009) USA	-84 women with breast cancer (stage 0-III)	Randomized control trial: MBSR/UC, n = 41/43)	STAI, CRS, CESDS, LOT, PSS, MOSSGHS MOSSS, spirituality	*no data for calculating effect size	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 compliant with MBSR associated with improvements in energy and physical functioning.

MBSR = Mindfulness-Based Stress Reduction; NEP = Nutrition Education Program; SRC = A mindfulness-based stress reduction clinic program; UC = Usual Care; BDI = Beck Depression Inventory; FC = Free choice; POMS = Profile of Mood States Scale; PENN = Penn State Worry Questionnaire; STAI = State-Trait Anxiety Inventory; FACIT-B = Functional Assessment of Cancer Treatment-Breast; SCI = Shapiro Control Inventory; SOC = Sense of Coherence; MAC = Mental Adjustment to Cancer Scale; MHLC = Multidimensional Health Locus of Control Scale; PF-SOC = Problem-Focused Styles of Coping; CES-D = Center for Epidemiologic Studies Depression Scale; MSCL = Medical Symptom Checklist; PSS = Perceived Stress Scale; MAAS = Mindful Attention Awareness Scale; CHIP = Coping with Health Injuries and Problems; QOL = Quality of Life Index Cancer Version III; JCS = Jalowiec Coping Scale; CRS = Concerns about Recurrence Scale; CESDS = Center for Epidemiological Studies Depression Scale; LOT = Life Orientation Test measured optimism; MOSSGHS = Medical Outcomes Studies Short form General Health Survey; MOSSS = Medical Outcomes Social Support Survey

Table 2. Studies of MBSR with heterogeneous types of cancer in which the predominant cancer was breast cancer

Study/ Country	Participants	Design	Measures	Effect Size (ES)	Findings
1. Speca et al. (2000) Canada	- 90 patients with heterogonous types and stages of cancer, predominantly breast cancer	Randomized, wait-list controlled clinical trial MBSR (n=53) wait-list (n=37)	-POMS -SOSI -POMS -SOSI	ES between group 0.819 0.607 ES pre-post within MBSR 0.717 0.782	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.
2. Carlson et al. (2001) Canada	-89 patients with heterogonous types and stages of cancer (same group from Speca et al., 2000)	One-group pretest-posttest design and follow-up at 6 months	-POMS -SOSI	ES1/2* 0.512/0.806 0.497/0.422 1 = post MBSR 2 = 6 months	Significant decreases were observed on POMS and SOSI scores which were maintained at 6-month follow-up, but not significant. More advanced stages of cancer were associated with less initial mood disturbance, while more home practice and higher initial POMS scores predicted improvements on the POMS from pre-to post intervention scores.
3. Brown & Ryan (2003) USA	- 32 early-stage breast and 9 prostate cancer patients *One study of a series of	One-group pretest-posttest design	-MAAS -POMS -SOSI -EORTC QLQ	*no data for calculating ES	Significantly decreased on stress. Neither MAAS nor POMS scores showed a significant change. The increase of MSSA was associated with the decrease of the POMS and

Study/ Country	Participants	Design	Measures	Effect Size (ES)	Findings
	studies in the development of the MAAS				the SOSI.
4. Carlson et al. (2003) Canada	- 49 (early stage) breast cancer, 10 prostate cancer	One-group pretest-posttest design	- EORTC QLQ C-30 *Function scale *Symptom scale -POMS -SOSI	0.209 0.266 0.153 0.064 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.
5. Carlson et al. (2004) Canada	- 49 (early stage) breast cancer, 10 prostate cancer	One-group pretest-posttest design	-EORTC QLQ C-30 -POMS -SOSI	0.505 0.273 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.
6. Carlson & Garland, (2005) Canada	-63 patients with heterogonous types and stages of cancer, predominantly breast cancer	One-group pretest-posttest design	- PSQI - SOSI - POMS	0.602 0.437 0.573	Significant decreased on overall sleep disturbance, stress, mood disturbance, and fatigue. Changes in stress and mood disturbance associated with fatigue.
7. Carlson et al. (2007) Canada	- 49 (early stage) breast cancer, 10 prostate cancer	One-group pretest-posttest design and follow-up at 6 and 12 months	-EORTC QLQ-C30) -POMS -SOSI	ES1/2/3* 0.26/0.08/0.29 0.00/0.01/0.16 0.28/0.30/0.40 1 = post MBSR	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.

Study/ Country	Participants	Design	Measures	Effect Size (ES)	Findings
				2 = 6 months 3 = 12 months	Systolic blood pressure (SBP) decreased.
8. Garland et al. (2007) Canada	-104 patients with heterogonous types and stages of cancer, predominantly breast cancer *participants were self-selected to: -8 week MBSR or -6 week HA	Non-randomized comparison design MBSR (n=60) and HA (n=44)	-PTGI-R -FACIT-Sp -SOSI -POMS -PTGI-R -FACIT-Sp -SOSI -POMS	ES between group 0.459 0.443 0.414 0.461 ES pre-post within MBSR 0.282 0.408 0.496 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 (SOSI), and overall mood disturbance (POMS) more than those in the HA group.
9. Kieviet-Stijnen et al. (2008) Netherlands	- 47 cancer patients, predominantly breast cancer	One-group pretest-posttest design and follow-up at 1 year	-VAS -RSC -POMS -HDI -MIL	ES1/2* 0.439/0.465 0.364/0.400 0.286/0.596 0.250/0.533 0.000/0.200 1 = post MBSR 2 = 1 year	Significant improved on quality of life, more joy in life, less tension, and fewer physical symptoms. A year later, a decrease was also found in depression, anger, vigor and total mood disturbance. No changes could be found for meaning in life and fatigue.

MBSR = Mindfulness-Based Stress Reduction; POMS = Profile of Mood States Scale; SOSI = Symptoms of Stress Inventory; MAAS = Mindful Attention Awareness Scale; EORTC QLQ-C = European Organization for Research and Treatment of Cancer Quality of Life Questionnaire; PSQI = Pittsburgh Sleep Quality Index; PTGI-R = Post-Traumatic Growth Inventory; FACIT-Sp = Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being; HA = Healing through the creative art; VAS = Visual Analogue Scale measured overall quality of life; RSC = Rotterdam Symptom Checklist measured physical symptoms; HDI = Health and Disease Inventory measured joy in life; MIL = Self-report scale measured experience meaning in life

Table 3. Effect sizes of MBSR on biological outcomes

Study/ participants/ design	Selected biological outcomes	Effect Size1	Effect Size2	Effect Size3
1. Carlson et al. (2007)		Post MBSR	6 months	12 months
49 breast and 10 prostate cancer patients	Total lymphocytes increase	0.169	0.183	0.103
One-group pre-post test	CD3 (% lymph) decrease	0.038	0.309	0.279
	CD4 (% lymph) decrease then increase	0.098	0.122	0.029
	CD8 (% lymph) decrease	0.041	0.239	0.240
	CD19 (% lymph) increase	0.040	0.193	0.215
	CD56 (% lymph) increase then decrease	0.120	0.169	0.195
	Cytokines (percent 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
	HR decrease	0.267	0.149	0.519

Study/ participants/ design	Selected biological outcomes	Effect Size1	Effect Size2	Effect Size3
2. Carlson et al. (2004)				
49 breast and 10 prostate cancer patients	Total cortisol decrease	0.087		
One-group pre-post test	Women cortisol decrease	0.078		
Cortisol collected at: 8 AM, 2 PM, 8 PM	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	0.950		
	Women melatonin increase	0.003		
3. Carlson et al. (2003)				
49 breast and 10 prostate cancer patients	Monocytes (percent of WBC) decrease	0.293		
One-group pre-post test	Eosinophils (percent of WBC) increase	0.310		
	IFN-λ T (% lymph) decrease	0.330		
	IL-4 T (% lymph) increase	1.007		
	IL-10 NK (% lymph) decrease	0.375		
4. Witek-Janusek et al. (2008)				
66 women with breast cancer	NKCA increase	0.472		
Non-randomized control trial	Product of IFN-λ increase	0.437		

Study/ participants/ design	Selected biological outcomes	Effect Size1	Effect Size2	Effect Size3
MBSR/non-MBSR, n = 38/28	IL-4 decrease	0.459		
	IL-6 decrease	0.571		
	IL-10 increase	0.309		
	plasma cortisol (4-6 pm) decrease	0.572		

IFN-λ = cytokines interferon gamma; TNF = tumor necrosis factor; IL = interleukin; SBP = systolic blood pressure; DBP = diastolic blood pressure; HR = heart rate; WBC = white blood cells; NK = natural killer; NKCA = natural killer cell activity

Appendix B: IRB Approval

Institutional Review Board
Health Sciences Section

University of Missouri-Columbia

125 Folk Hall
One Hospital Drive
Columbia, MO 65212
PHONE (573) 882-3181
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November 25, 2008

Yaowarat Matchim
School of Nursing
DC116.05
One Hospital Drive
Columbia, MO 65212

Dear Yaowarat Matchim,

Regarding your application for approval of the research project, ***A qualitative and quantitative study examining effects of Mindfulness-Based Stress Reduction (MBSR) on the physical and psychological well-being of breast cancer survivors***, the Health Sciences Institutional Review Board (HS IRB) took the following action:

a. Approved your study through expedited review [as codified under 45 CFR 46.110 (f) (4) (7)] on November 21, 2008.
b. Found this protocol to impose minimal risk to the research participant.
c. The HS IRB has waived the requirement for the investigator to obtain a signed consent form for all research participants in accordance with 45 CFR 46.116 (d). Although the requirement to obtain a signature has been waived, a copy of the consent script that was approved on November 25, 2008 must be given to each research participant to keep for his or her records.
d. Reviewed and approved any advertisements or other recruitment materials that were submitted with your application.
e. Reviewed and approved the HIPAA Authorization on November 25, 2008.
f. The HS IRB has determined that the degree of risk is such that the approval for this protocol will expire on November 21, 2009. A Continuing Review Report must be submitted a minimum of one month prior to this date.
g. Upon completion of the study a Completion Form must be submitted to the HS IRB office. If the closure is not documented on the Completion Form, you may close the study at the time of the annual review.

Please reference **IRB Project # 1126177** in all future communications regarding this project.

Pursuant to the HS IRB conflict of interest policy, investigators who are HS IRB members do not vote on protocols in which they are involved.

Death occurring in a study at this site must be reported to the HS IRB office within 24 hours of occurrence, whether or not the death is related to the study. All on-site serious adverse events must be reported to the HS IRB office within five (5) days of occurrence.

No change may be made in an approved protocol or recruitment materials unless the change is submitted to and approved by the HS IRB.

Do not depend on the HS IRB for your record keeping. Pursuant to federal regulations, the IRB retains files of only three years after termination of a research project.

Sincerely,

Niels Beck, PhD
Chair

Enclosure

Appendix C: Demographic information and health behaviors

Appendix C Birth Date:……/……/…….
(month /day /year)

Demographic information and health behaviors

Please complete the information below

1. Age……years
2. Education……(years), occupation……
3. Married status □ single □ married □ widow □ divorced
4. Religion □ Buddhist □ Christian □ Muslim

   □ Hindu □ others (identify)…….
5. Breast cancer diagnosis stage……affected side……date of diagnosis……...
6. What breast cancer treatments have you received……...

   …….

   date…….…….
7. Do you have other diseases, health problems, physical problems or symptoms that make you feel uncomfortable? □ No □ Yes (please identify)

   ……..……

   ……

   ……
8. Do you take any medication? □ No □ Yes (please identify)

   ……

   ……

   ……

   ……

   ……....

9. Do you consume tea, coffee, or any soft-drink with caffeine or alcohol, herbs?

   □ No □ Yes (please identify/ how often?)……..

   ……

   …….

10. Do you exercise? □ No □ Yes (please identify……

    Duration…….minutes/…….times/week)

11. Do you smoke? □ No □ Yes (how many cigarettes/ day)…….

12. Do you have sleep problems? □ No □ Yes (how often?)

……

13. How many hours do you routinely sleep/ night?.....

14. Quality of sleep, please rate: □ poor □ adequate □ good

15. Quality of diet, please rate: □ poor □ adequate □ good

Appendix D: Self-Report of Daily Meditation Practice at Home

Appendix D

Self-report form of daily meditation practice at home

Practice Exercise Record Form – Class 1

Record each time you practice. If you wish, make a note of anything that comes up during practice so that we can talk about it at the next meeting.

Day: Date: Practice: Yes / No CD: Time…….minutes	Comments:
Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	

Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	

Practice Exercise Record Form – Class 2

Record each time you practice. If you wish, make a note of anything that comes up during practice so that we can talk about it at the next meeting.

Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	Comments:
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	

Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	

Pleasant Experiences Record Form

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Practice Exercise Record Form – Class 3

Record each time you practice. If you wish, make a note of anything that comes up during practice so that we can talk about it at the next meeting.

Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	Comments:
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	

Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	

Unpleasant Experiences Record Form

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Day: Date:

Situation	Body Sensations	Emotions	Thoughts

Practice Exercise Record Form – Class 4

Record each time you practice. If you wish, make a note of anything that comes up during practice so that we can talk about it at the next meeting.

Day: Date: Practice: Yes / No CD: Time…….minutes	Comments:
Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	

Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	

Practice Exercise Record Form – Class 5

Record each time you practice. If you wish, make a note of anything that comes up during practice so that we can talk about it at the next meeting.

Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	Comments:
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	

Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	
Day: Date: Practice: Yes / No CD: Sitting: Time…….minutes	

Difficult Communications Calendar

Day: Date:

Describe the Situation	What did you really want or need? What did you actually get?	What did the other person want or need? What did they actually get?	How did you feel during and after this time?	What was resolved and/or not resolved?

Day: Date:

Describe the Situation	What did you really want or need? What did you actually get?	What did the other person want or need? What did they actually get?	How did you feel during and after this time?	What was resolved and/or not resolved?

Day: Date:

Describe the Situation	What did you really want or need? What did you actually get?	What did the other person want or need? What did they actually get?	How did you feel during and after this time?	What was resolved and/or not resolved?

Day: Date:

Describe the Situation	What did you really want or need? What did you actually get?	What did the other person want or need? What did they actually get?	How did you feel during and after this time?	What was resolved and/or not resolved?

Day: Date:

Describe the Situation	What did you really want or need? What did you actually get?	What did the other person want or need? What did they actually get?	How did you feel during and after this time?	What was resolved and/or not resolved?

Day: Date:

Describe the Situation	What did you really want or need? What did you actually get?	What did the other person want or need? What did they actually get?	How did you feel during and after this time?	What was resolved and/or not resolved?

Day: Date:

Describe the Situation	What did you really want or need? What did you actually get?	What did the other person want or need? What did they actually get?	How did you feel during and after this time?	What was resolved and/or not resolved?

Practice Exercise Record Form – Class 6

Record each time you practice. If you wish, make a note of anything that comes up during practice so that we can talk about it at the next meeting.

Day: Date: Practice: Yes / No CD: Time…….minutes	Comments:
Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	

Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	
Day: Date: Practice: Yes / No CD: Time…….minutes	

Practice Exercise Record Form – Class 7

Record each time you practice. If you wish, make a note of anything that comes up during practice so that we can talk about it at the next meeting.

Day: Date: Practice: Yes / No CD: Time……minutes	Comments:
Day: Date: Practice: Yes / No CD: Time……minutes	
Day: Date: Practice: Yes / No CD: Time……minutes	

Day: Date: Practice: Yes / No CD: Time……minutes	
Day: Date: Practice: Yes / No CD: Time……minutes	
Day: Date: Practice: Yes / No CD: Time……minutes	
Day: Date: Practice: Yes / No CD: Time……minutes	

Appendix E: Profile of Mood States (POMS) Short Form

POMS™ Brief Form

BY DOUGLAS M. McNAIR, Ph.D., MAURICE LORR, Ph.D., JW P. HEUCHERT, Ph.D., & LEO F. DROPPLEMAN, Ph.D.

Name:_____ **Age:**_____ **Gender:** Male Female
(Circle one)

Birth Date:_____/_____/_____ **Today's Date:**_____/_____/_____
Month Day Year Month Day Year

To the Administrator:

Place a checkmark ✔ in one box to specify the time period of interest.

To the Respondent:

Below is a list of words that describe feelings that people have. Please read each word carefully. Then circle the number that best describes

☐ how you have been feeling during the PAST WEEK, INCLUDING TODAY.
☐ how you feel RIGHT NOW.
☐ other: _____

If no box is marked, please follow the instructions for the first box.

POMS™

		Not at all	A little	Moderately	Quite a bit	Extremely
1.	Tense	0	1	2	3	4
2.	Angry	0	1	2	3	4
3.	Worn out	0	1	2	3	4
4.	Lively	0	1	2	3	4
5.	Confused	0	1	2	3	4
6.	Shaky	0	1	2	3	4
7.	Sad	0	1	2	3	4
8.	Active	0	1	2	3	4
9.	Grouchy	0	1	2	3	4
10.	Energetic	0	1	2	3	4
11.	Unworthy	0	1	2	3	4
12.	Uneasy	0	1	2	3	4
13.	Fatigued	0	1	2	3	4
14.	Annoyed	0	1	2	3	4
15.	Discouraged	0	1	2	3	4
16.	Nervous	0	1	2	3	4
17.	Lonely	0	1	2	3	4
18.	Muddled	0	1	2	3	4
19.	Exhausted	0	1	2	3	4
20.	Anxious	0	1	2	3	4
21.	Gloomy	0	1	2	3	4
22.	Sluggish	0	1	2	3	4
23.	Weary	0	1	2	3	4
24.	Bewildered	0	1	2	3	4
25.	Furious	0	1	2	3	4
26.	Efficient	0	1	2	3	4
27.	Full of pep	0	1	2	3	4
28.	Bad-tempered	0	1	2	3	4
29.	Forgetful	0	1	2	3	4
30.	Vigorous	0	1	2	3	4

Please ensure you have answered every item.

POMS™ Brief Scoring Grid

BY DOUGLAS M. McNAIR, Ph.D., MAURICE LORR, Ph.D., JW P. HEUCHERT, Ph.D., & LEO F. DROPPLEMAN, Ph.D.

Name:_____ **Age:**_____ **Gender:** Male Female
(Circle one)

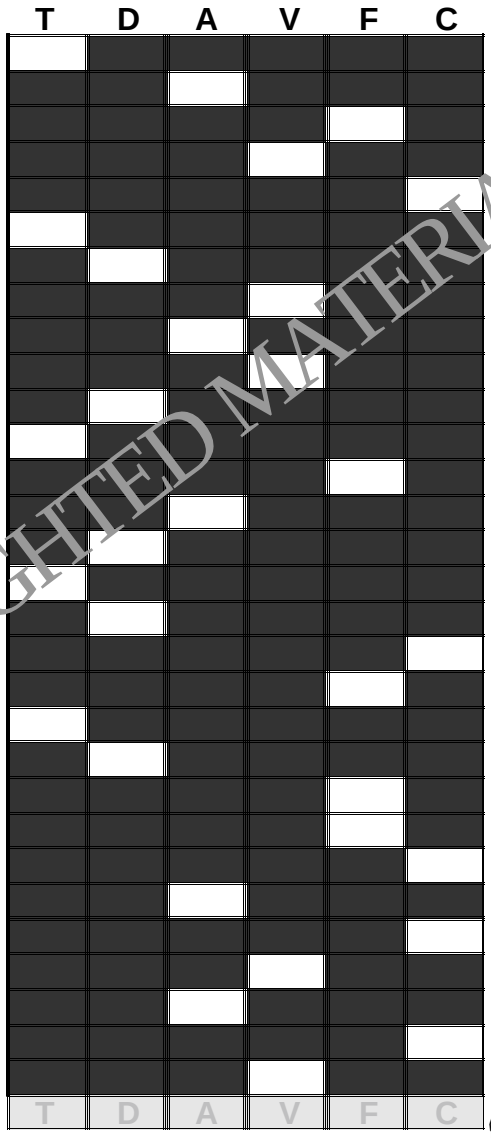
Birth Date:_____/_____/_____ **Today's Date:**_____/_____/_____
Month Day Year Month Day Year

Instructions:

For each item, transfer each circled score into the corresponding unshaded box in the scoring section below. Each circled number should be copied once.

For example, if "3" is circled, transfer "3" to the corresponding unshaded box on the same row:

0 ..... 1 ..... 2 ..... 3 4



0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 1.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 2.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 3.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 4.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 5.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 6.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 7.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 8.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 9.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 10.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 11.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 12.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 13.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 14.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 15.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 16.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 17.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 18.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 19.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 20.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 21.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 22.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 23.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 24.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 25.
4 ..... 3 ..... 2 ..... 1 ..... 0 ..... 26.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 27.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 28.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 29.
0 ..... 1 ..... 2 ..... 3 ..... 4 ..... 30.

T D A V F C

To obtain raw scores for factors T, D, A, V, F, and C, add the numbers in each column and enter the sum in the box at the bottom of the column.

Sum T, D, A, F, and C and subtract V in the boxes below to obtain the Total Mood Disturbance (TMD) score.

Plot the Raw Scores for each factor on the POMS Brief Profile on the next page of this QuikScore™ form. No *T*-scores are provided for the TMD.

Raw Score [T] + [D] + [A] + [F] + [C] − [V] = [TMD] **Total Mood Disturbance**

POMS™ Brief Profile

BY DOUGLAS M. McNAIR, Ph.D., MAURICE LORR, Ph.D., JW P. HEUCHERT, Ph.D., & LEO F. DROPPLEMAN, Ph.D.

Name:_____ **Age:**_____ **Gender:** Male Female
(Circle one)

Birth Date:_____/_____/_____ **Today's Date:**_____/_____/_____
Month Day Year Month Day Year

	Factor						
***T*-Score**	**Ten**	**Dep**	**Ang**	**Vig**	**Fat**	**Con**	***T*-Score**
80+				20			80+
79							79
78				19			78
77							77
76			20	18	20		76
75						20	75
74			19		19		74
73				17		19	73
72			18				72
71				16	18	18	71
70			17				70
69		20		15	17	17	69
68			16				68
67	20	19		14	16	16	67
66		18	15				66
65	19			13		15	65
64		17	14		15		64
63	18						63
62		16	13	12	14	14	62
61	17						61
60		15	12	11	13	13	60
59	16						59
58	15	14	11	10		12	58
57					12		57
56	14	13	10	9		11	56
55		12			11		55
54	13		9	8		10	54
53		11			10		53
52	12		8	7		9	52
51		10					51
50	11		7		9	8	50
49		9		6			49
48	10		6		8	7	48
47		8		5			47
46	9		5		7	6	46
45	8	7		4			45
44			4			5	44
43	7	6		3	6		43
42		5	3			4	42
41	6			2	5		41
40		4	2			3	40
39	5			1	4		39
38		3	1				38
37	4				3	2	37
36		2	0	0			36
35	3					1	35
34		1			2		34
33	2					0	33
32	1	0			1		32
31							31
≤30	0				0		≤30

Appendix F: Calgary Symptoms of Stress Inventory (C-SOSI)

APPENDIX F BIRTH DATE……./……../……...

CALGARY SYMPTOMS OF STRESS INVENTORY (CSOSI)

This questionnaire is designed to measure the different ways people respond to stressful situations. The questionnaire contains sets of questions dealing with various physical, psychological and behavioral responses. We are particularly interested in the frequency with which you may have experienced these stress related symptoms during the **past week**.

		Never	Infrequently	Sometimes	Often	Very frequently
Stress is often accompanied by a variety of emotions. During the last week, have you felt:						
D1	Like life is entirely hopeless	0	1	2	3	4
D2	Unhappy and depressed	0	1	2	3	4
D3	Alone and sad	0	1	2	3	4
D5	That worrying gets you down	0	1	2	3	4
D4	Like crying easily	0	1	2	3	4
D6	That you wished you were dead	0	1	2	3	4
D7	Frightening thoughts keep coming back	0	1	2	3	4
D8	You suffer from severe nervous exhaustion	0	1	2	3	4
Does it seem:						
A1	You become mad or anger easily	0	1	2	3	4
A2	When you feel angry, you act angrily toward most everything	0	1	2	3	4
A3	You are easily annoyed and irritated	0	1	2	3	4
A4	That little things get on your nerves	0	1	2	3	4
A5	Angry thoughts about an irritating event keep bothering you	0	1	2	3	4
A6	You let little annoyances build up until you just explode	0	1	2	3	4
A7	Your anger is so great that you want to strike something	0	1	2	3	4

Kindly select the frequency with which you may have experienced these symptoms during the **past week**.		Never	Infrequently	Sometimes	Often	Very frequently
Muscle tension is a common way of experiencing stress. Have you noticed excessive tension, stiffness, soreness or cramping in the muscles in your:						
MT1	Shoulders	0	1	2	3	4
MT2	Neck	0	1	2	3	4
MT3	Back	0	1	2	3	4
MT4	Jaw	0	1	2	3	4
MT5	Forehead	0	1	2	3	4
MT6	Eyes	0	1	2	3	4
MT7	Hands or arms	0	1	2	3	4
MT8	Tension headaches	0	1	2	3	4
Does it seem:						
C1	Thumping of your heart	0	1	2	3	4
C2	Rapid or racing heart beats	0	1	2	3	4
C3	Rapid breathing	0	1	2	3	4
C4	Irregular heart beats	0	1	2	3	4
C5	Difficult breathing	0	1	2	3	4
C6	Pains in your heart of chest	0	1	2	3	4
Do you experience:						
SA1	Difficulty in staying asleep at night	0	1	2	3	4
SA2	Hot or cold spells	0	1	2	3	4
SA3	Having to get up in the night to urinate	0	1	2	3	4
SA4	Sweating excessively even in cold weather	0	1	2	3	4
SA5	Having to urinate frequently	0	1	2	3	4
SA6	Early morning awakening	0	1	2	3	4
SA7	Flushing of your face	0	1	2	3	4

Kindly select the frequency with which you may have experienced these symptoms during the **past week**.		Never	Infrequently	Sometimes	Often	Very frequently
SA8	Difficulty in falling asleep	0	1	2	3	4
SA9	Breaking out in cold sweats	0	1	2	3	4
Have you experienced:						
NG1	Feeling faint	0	1	2	3	4
NG2	Feeling weak and faint	0	1	2	3	4
NG3	Spells of severe dizziness	0	1	2	3	4
NG4	Nausea	0	1	2	3	4
NG5	Blurring of your vision	0	1	2	3	4
NG6	Severe pains in your stomach	0	1	2	3	4
Does it seem:						
CD1	You must do things very slowly to do them without mistakes	0	1	2	3	4
CD2	You get directions and orders wrong	0	1	2	3	4
CD3	Your thinking gets completely mixed-up when you have to do things quickly	0	1	2	3	4
CD4	You have difficulty in concentrating	0	1	2	3	4
CD5	You become suddenly frightened for no good reason	0	1	2	3	4
CD6	You become so afraid you can't move	0	1	2	3	4
Have you experienced:						
UR1	Colds	0	1	2	3	4
UR2	Hoarseness	0	1	2	3	4
UR3	Colds with complications (e.g. Bronchitis)	0	1	2	3	4
UR4	Nasal stuffiness	0	1	2	3	4
UR5	Having to clear your throat often	0	1	2	3	4
UR6	Sinus headaches	0	1	2	3	4

Appendix G: Five Facet Mindfulness Questionnaire (FFMQ)

Appendix G

Subject number_____ **Birth Date……/……./…….**
(month/ day/ year)

5-FACET M QUESTIONNAIRE

Please rate each of the following statements using the scale provided. Write the number in the blank that best describes <u>your own opinion</u> of what is <u>generally true for you</u>.

1	2	3	4	5
never or very rarely true	**rarely true**	**sometimes true**	**often true**	**very often or always true**

_____ 1. When I'm walking, I deliberately notice the sensations of my body moving.
_____ 2. I'm good at finding words to describe my feelings.
_____ 3. I criticize myself for having irrational or inappropriate emotions.
_____ 4. I perceive my feelings and emotions without having to react to them.
_____ 5. When I do things, my mind wanders off and I'm easily distracted.
_____ 6. When I take a shower or bath, I stay alert to the sensations of water on my body.
_____ 7. I can easily put my beliefs, opinions, and expectations into words.
_____ 8. I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.
_____ 9. I watch my feelings without getting lost in them.
_____ 10. I tell myself I shouldn't be feeling the way I'm feeling.
_____ 11. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.
_____ 12. It's hard for me to find the words to describe what I'm thinking.
_____ 13. I am easily distracted.
_____ 14. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.
_____ 15. I pay attention to sensations, such as the wind in my hair or sun on my face.
_____ 16. I have trouble thinking of the right words to express how I feel about things
_____ 17. I make judgments about whether my thoughts are good or bad.
_____ 18. I find it difficult to stay focused on what's happening in the present.
_____ 19. When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.
_____ 20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.
_____ 21. In difficult situations, I can pause without immediately reacting.
_____ 22. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.

1	2	3	4	5
never or very rarely true	**rarely true**	**sometimes true**	**often true**	**very often or always true**

_____ 23. It seems I am "running on automatic" without much awareness of what I'm doing.

_____24. When I have distressing thoughts or images, I feel calm soon after.

_____ 25. I tell myself that I shouldn't be thinking the way I'm thinking.

_____ 26. I notice the smells and aromas of things.

_____ 27. Even when I'm feeling terribly upset, I can find a way to put it into words.

_____ 28. I rush through activities without being really attentive to them.

_____ 29. When I have distressing thoughts or images I am able just to notice them without reacting.

_____ 30. I think some of my emotions are bad or inappropriate and I shouldn't feel them.

_____ 31. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.

_____ 32. My natural tendency is to put my experiences into words.

_____ 33. When I have distressing thoughts or images, I just notice them and let them go.

_____ 34. I do jobs or tasks automatically without being aware of what I'm doing.

_____ 35. When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about.

_____ 36. I pay attention to how my emotions affect my thoughts and behavior.

_____ 37. I can usually describe how I feel at the moment in considerable detail.

_____ 38. I find myself doing things without paying attention.

_____ 39. I disapprove of myself when I have irrational ideas.

Appendix H: Biological Data Collected Form

Appendix H

Biological form

Subject number…… Birth Date……/……/……..
(month/ day / year)

Note: measure 2 times for each variable/ each measurement

Measurement/time	**T1**		**T2**		**T3**	
Date						
	1st	2nd	1st	2nd	1st	2nd
Blood pressure (BP) mmHg						
Respiratory rate (RR) /minute						
Heart Rate (HR) /minute						
Body weight (BW) lb						
Salivary cortisol (for some cases)						

Appendix I: Instructions for Salivary Collection

Study of Mindfulness-Based Stress Reduction (MBSR)
Instructions for Salivary Collection

<u>Thank</u> <u>You</u> for your help with this study!

You'll collect a spit sample two times a day, for three days at pre-post MBSR program and at 1 month follow-up (September 16, November 11, and December 9).

- One each morning, within 30 minutes after you wake up…
- One each afternoon at 4 pm.

See inside for instructions. We'll call to remind you when to start collecting the spit. If you have *any* questions or problems, call me for help, any day, any time. *Yao @ 573-289-5665* or Melanie @ 573-355-0185

Collect In The Morning… As Soon As You Wake Up.

The most accurate morning cortisol is done as soon as you wake up. Don't wait for more than a half an hour after you wake up to collect the spit. If the timing is off, just let me know by writing it in the diary.

Each tube is numbered. The morning tubes also say "A.M.":
How To Collect the Morning Sample:

1. Don't eat, drink, smoke, or brush your teeth until **after** you collect the sample. (It's OK to drink water).
2. Rinse your mouth out with water and wait 10 minutes.
3. You'll have a new tube and swab
4. Take the swab out of the tube. Put it under your tongue until it gets wet—about 1 or 2 minutes.
5. Put the swab back into the tube, and put the cap back on.
6. Put the whole thing—tube and swab-- in your freezer **immediately.**
7. Check it off on the diary. Make a note if there were any problems or questions.

Collect In The Afternoon at 4 pm.

Collect the afternoon sample at 4 pm

The afternoon tubes also say "P.M.:

How To Collect the Afternoon Sample:

1. Don't eat, drink, smoke, or brush your teeth for 30 minutes **before** you collect the sample. (It's OK to drink water).
2. Rinse your mouth out with water and wait 10 minutes.
3. Use a new night tube and swab each night.
4. Take the swab out of the tube. Put it under your tongue until it gets wet—about 1 or 2 minutes.
5. Put the swab back into the tube, and put the cap back on.
6. Put the whole thing—tube and swab-- in your freezer **immediately.**
7. Match the number on the tube with the number on the diary. Check it off on the diary. Make a note if there were any problems or questions.

Spit Diary.

Day 1 Date: September 23

Morning Sample: Is it Tube AM? Yes

Time you woke up: _____

Time you collected the sample: _____

Notes about things that can change the result (please circle):

Anything to drink before (except water)?	Yes/No
Anything to eat before?	Yes/No
Did you smoke before?	Yes/ No
Did you brush your teeth before?	Yes/No
Do you have to work today?	Yes/No

Notes, problems, or questions:

Day 1 Date: September 23

Afternoon Sample – Is it Tube 4 PM? Yes

Time you collected the sample: _____

Notes about things that can change the result (please circle):

Anything to drink less than 30 minutes before (except water)?	Yes/No
Anything to eat less than 30 minutes before?	Yes/No
Smoke less than 30 minutes before?	Yes/No
Brush teeth less than 30 minutes before?	Yes/No

How was your stress today?

Notes, problems, or questions:

Day 2 Date: November 11

Morning Sample: Is it Tube AM? Yes

Time you woke up: _____

Time you collected the sample: _____

Notes about things that can change the result (please circle):

Anything to drink before (except water)?	Yes/ No
Anything to eat before?	Yes/ No
Did you smoke before?	Yes/ No
Did you brush your teeth before?	Yes/ No
Do you have to work today?	Yes/ No

Notes, problems, or questions:

Day 2 Date: November 11

Afternoon Sample – Is it Tube 4 PM? Yes

Time you collected the sample: _____

Notes about things that can change the result (please circle):

Anything to drink less than 30 minutes before (except water)?	Yes/No
Anything to eat less than 30 minutes before?	Yes/No
Smoke less than 30 minutes before?	Yes/No
Brush teeth less than 30 minutes before?	Yes/No

How was your stress today?

Notes, problems, or questions:

Day 3 Date: December 9

Morning Sample: Is it Tube AM? Yes

Time you woke up: _____

Time you collected the sample: _____

Notes about things that can change the result (please circle):

Anything to drink before (except water)?	Yes/No
Anything to eat before?	Yes/No
Did you smoke before?	Yes/ No
Did you brush your teeth before?	Yes/No
Do you have to work today?	Yes/No

Notes, problems, or questions:

Day 3 Date: December 9
Afternoon Sample – Is it Tube 4 PM? Yes

Time you collected the sample: _____

Notes about things that can change the result (please circle):

Anything to drink less than 30 minutes before (except water)?	Yes/No
Anything to eat less than 30 minutes before?	Yes/No
Smoke less than 30 minutes before?	Yes/No
Brush teeth less than 30 minutes before?	Yes/No

How was your stress today?

Notes, problems, or questions:

Frequently Asked Questions About Spit Collection:

What are you looking for in the spit?
I'm testing for a stress hormone called cortisol. Only cortisol is tested in this study—nothing else.

How do you test for cortisol? The spit gets sent off to a laboratory.

Will my name be on the sample?
Your name isn't on your samples, or anything else in the study-- only a number code. Your privacy as a research participant is important to me.

Why do you want the morning sample to be no more than a half-hour after I wake up?
This is called a baseline level. For most people, cortisol levels will start to rise 30-45 minutes after they wake up.

What happens if I eat, drink, brush my teeth, or smoke less than 30 minutes before I collect the sample?
It can change the results of the test. It's best if you can avoid eating, drinking, or smoking before you collect the sample—but if not, just mark it on the diary I'll know why that sample looks different.

How soon do I need to get the sample in the freezer?
It's best to do it right away. If you can't get to a freezer for 1-2 hours, put it in a cool place (like a refrigerator, or a cooler with an ice pack) until it can be frozen.

What do I do if I have other questions?
Call me (Yao) at 573-289-5665 anytime or Melanie at 573-355-0185. We are glad to talk to you and answer your questions!

Appendix J: Semi-Structured Interview Guide

Appendix J: Semi-Structured Interview Guide

Experience in practicing mindfulness meditation

1. Why you decided to participate in the MBSR program?
2. What did you learn from participating in the MBSR program?
3. After practicing mindfulness meditation, have you found something has changed in yourself, your life, your ideas, your attitudes, your feeling, and/or your perception of your life and others around you?
4. Please explain to me how you used the MBSR to cope with your illness or stressors in your life.
5. What are aspects of the MBSR program that were most helpful to you?
6. What problems have you experienced in practicing mindfulness meditation?
7. Did you have pleasant or unpleasant experiences during practicing mindfulness meditation?
8. Please explain to me about pleasant and unpleasant experiences that you have during practicing mindfulness meditation.
9. What role does mindfulness meditation play in your current life?
10. How would you tell other people about the MBSR program?
11. What additional information would you like to share with me about mindfulness meditation?

Appendix K: Announcements for Recruitment

Invitation to participate in a study of

Mindfulness-Based Stress Reduction

We invite 40 breast cancer survivors who are…

(1) Age 18 years or older (2) Stage 0, I, or II breast cancer

(3) Speak and understand English (4) Are at least 3 months following completion of active treatment (surgery, radiation, or chemotherapy)

To participate in the **8-week** Mindfulness-Based Stress Reduction (MBSR) program, which will be taught by an experienced meditation teacher (Lynn Rossy, PhD) at Ellis Fischel Cancer Center, on Wednesdays from 5:00-7:00 PM, beginning September 16, 2009 (**Free tuition**, Normally, the cost per person is between $350 – 650.00).
This is Yaowarat (Yao)'s dissertation.

For more information please contact:

Melanie Schneider, MPH, Research Assistant

E-mail: mksg28@mizzou.edu **or** mnmelanie@hotmail.com

Telephone (573) 884-3249

MU Sinclair School of Nursing; **IRB Project # 1126177**

Appendix L: Informed Consent

CONSENT FORM TO PARTICIPATE IN A RESEARCH STUDY

MU Sinclair School of Nursing at Ellis Fischel Cancer Center University of Missouri

Investigator's Name: Yaowarat Matchim, MS, RN
Project # 1126177
Date of Project Approval: November 21, 2008

FOR HSIRB USE ONLY
APPROVED
HS IRB Authorized Representative 11/25/08 Date
EXPIRATION DATE: 11.21.09

Study Title: A qualitative and quantitative study examining effects of Mindfulness-Based Stress Reduction (MBSR) on the physical and psychological well-being of breast cancer survivors

INTRODUCTION

This consent may contain words that you do not understand. Please ask the investigator or the study staff to explain any words or information that you do not clearly understand.

This is a research study. Research studies include only people who choose to participate. As a study participant you have the right to know about the procedures that will be used in this research study so that you can make the decision whether or not to participate. The information presented here is simply an effort to make you better informed so that you may give or withhold your consent to participate in this research study.

Please take your time to make your decision and discuss it with your family and friends.

You are being asked to take part in this study because you have the diagnosis of breast cancer.

In order to participate in this study, it will be necessary to give your written consent.

WHY IS THIS STUDY BEING DONE?

The purpose of this study is to measure the effect of the Mindfulness-Based Stress Reduction (MBSR) program on physiological and psychological outcomes and to explore the experience of practicing MBSR among breast cancer survivors.

How Many People Will Take Part In The Study?

About 35 breast cancer survivors will take part in this MU Sinclair School of Nursing study

What Is Involved in the Study?

If you take part in this study you will be asked to participate in Mindfulness-Based Stress Reduction class. It is a 2-2.5 hours-weekly class lasting for 8 weeks. You will be taught to practice mindfulness meditation, yoga and related strategies of stress reduction.

You will be measured respiratory rate (RR), heart rate (HR), body weight (BW), blood pressure (BP), and salivary cortisol. Salivary cortisol measurement can determine your stress levels. Saliva swabs will be carried out in a private setting with the researcher who has been trained. No anticipated risks are associated with salivary cortisol measurement. You will be asked to complete questionnaires, including personal information, stress-mood measurement, and well-being measurement.

All of these measurements will be done a minimum of 3 times: 1 week before the meditation program starts; right after the meditation program is completed; and 3 moths after the meditation program is completed.

After the meditation program is completed, you will be asked to participate in an individual interview with an audiotape record which will take approximately 20-30 minutes. Dates and times will be offered to make appointments for the interview. You can choose time and places that you prefer for the interview. You may choose not to answer any questions that make you feel uncomfortable.

How Long Will I Be in the Study?

Your participation will last about 6 months. The mindfulness meditation is an 8-week program. The measurements will be done 1 week before the program and right after the program is completed and will be follow-up at 3 months.

You can stop participating at any time. Your decision to withdraw from the study will not affect in any way your medical care and/or benefits.

What Are the Risks of the Study?

You may concern about loss of confidentiality. In this study, data will not identify your name. The personal information will be coded and analyzed. Data will be presented as a group of population, not individual's information.

Are There Benefits to Taking Part in the Study?

If you agree to take part in this study, you will be asked to participate in the Mindfulness-Based Stress Reduction program. Participating in this program, you will receive direct benefits, including possible psychological improvements, such as stress reduction, and physical aspect improvements, such as decrease in heart rate, blood pressure, and respiratory rate. You may also expect to benefit from taking part in this research to the extent that you are contributing to knowledge about effects of mindfulness meditation practice to health.

WHAT OTHER OPTIONS ARE THERE?

An alternative is to not participate in this research study.

WHAT ABOUT CONFIDENTIALITY?

Information produced by this study will be stored the investigator's file and identified by a code number only. The code key connecting your name to specific information about you will be kept in a separate, secure location. Information contained in your records may not be given to anyone unaffiliated with the study in a form that could identify you without your written consent, except as required by law.

It is possible that your medical and/or research record, including sensitive information and/or identifying information, may be inspected and/or copied by the study sponsor (and/or its agent), the Food and Drug Administration (FDA), federal or state government agencies, or hospital accrediting agencies, in the course of carrying out their duties. If your record is inspected or copied by the study sponsor (and/or its agents), or by any of these agencies, the MU Sinclair School of Nursing will use reasonable efforts to protect your privacy and the confidentiality of your medical information.

The results of this study may be published in a nursing or medical book or journal or used for teaching purposes. However, your name or other identifying information will not be used in any publication or teaching materials without your specific permission.

In addition, if photographs, audiotapes or videotapes were taken during the study that could identify you, then you must give special written permission for their use. In that case, you will be given the opportunity to view or listen, as applicable, to the photographs, audiotapes or videotapes before you give your permission for their use if you so request.

WHAT ARE THE COSTS?

You will not experience any costs as a result of the activities of this study.

WILL I BE PAID FOR PARTICIPATING IN THE STUDY?

You will receive no payment for taking part in this study.

WHAT IF I AM INJURED?

It is not the policy of the University of Missouri to compensate human subjects in the event the research results in injury. The University of Missouri, in fulfilling its public responsibility, has provided medical, professional and general liability insurance coverage for any injury in the event such injury is caused by the negligence of the University of Missouri, its faculty and staff. The University of Missouri also will provide, within the limitations of the laws of the State of Missouri, facilities and medical attention to subjects who suffer injuries while participating in the research projects of the University of Missouri. In the event you have suffered injury as the result of participation in this research program, you are to contact the Risk Management Officer, telephone number (573) 882-1181, at the Health Sciences Center, who can review the matter and provide further information. This statement is not to be construed as an admission of liability.

WHAT ARE MY RIGHTS AS A PARTICIPANT?

Participation in this study is voluntary. You do not have to participate in this study. Your present or future care will not be affected should you choose not to participate. If you decide to participate, you can change your mind and drop out of the study at any time without affecting your present or future care in the study at any time without affecting your present or future care.

WHOM DO I CALL IF I HAVE QUESTIONS OR PROBLEMS?

You may ask more questions about the study at any time. For questions about the study or a research-related injury, contact:

Yaowarat Matchim, RN, MS, Principal investigator at (573) 289-5665
Jane Armer, RN, PhD, Co-investigator at (573) 882-0287

If you have any questions regarding your rights as a participant in this research and/or concerns about the study, or if you feel under any pressure to enroll or to continue to participate in this study, you may contact the University of Missouri Health Sciences Institutional Review Board (which is a group of people who review the research studies to protect participants' rights) at (573) 882-3181.

A copy of this consent form will be given to you to keep.

SIGNATURE

I confirm that the purpose of the research, the study procedures, the possible risks and discomforts as well as potential benefits that I may experience have been explained to me. Alternatives to my participation in the study also have been discussed. I have read this consent form and my questions have been answered. My signature below indicates my willingness to participate in this study.

_____ _____
Participant Date

_____ _____
Witness (if required)* Date

*The presence and signature of an impartial witness is required during the entire informed consent discussion if the patient or patient's legally authorized representative is unable to read.

SIGNATURE OF STUDY REPRESENTATIVE

I have explained the purpose of the research, the study procedures, identifying those that are investigational, the possible risks and discomforts as well as potential benefits and have answered questions regarding the study to the best of my ability.

Study Representative****

Date

****Study Representative is a person authorized to obtain consent. Per the policies of the University of Missouri Health Care, for any 'significant risk/treatment' study, the Study Representative must be a physician who is either the Principal or Co-Investigator. If the study is deemed either 'significant risk/non-treatment' or 'minimal risk,' the Study Representative may be a non-physician study investigator.

Appendix M: HIP AA Authorization Form

UNIVERSITY OF MISSOURI-COLUMBIA
Institutional Review Board

HIPAA AUTHORIZATION FORM

Authorization for the Use and Disclosure of Personal Health Information Resulting from Participation in a Research Study

FOR IRB USE ONLY	
APPROVED	
IRB Authorized Representative	Date 11/15/06

Principal Investigator's Name: Yaowarat Matchim, MS, RN
Project # 1126177
Project Title: A qualitative and quantitative study examines effects of mindfulness-based stress reduction (MBSR) on the physical and psychological aspects of breast cancer survivors

You have agreed to participate in the study mentioned above. This authorization form gives more detailed information about how your health information will be protected.

1. Description of the information
My authorization applies to the information described below. Only this information may be used and/or disclosed in accordance with this authorization:
Heart rate (HR), respiratory rate (RR), blood pressure (BP), body weight (BW), salivary cortisol, Demographic, brief medical history, and psychosocial data

2. Who may use and/or disclose the information
I authorize the following persons (or class of persons) to make the authorized use and disclosure of my PHI:
The principal investigator and co-investigator.

3. Who may receive the information
I authorize the following persons (or class of persons) to receive my personal health information
Funding agency; IRB/HIPPA; publications/ presentations; educational projects

4. Purpose of the use or disclosure
My PHI will be used and/or disclosed upon request for the following purposes:

- x☐ Auditing
- x☐ Study outcomes including safety and efficacy
- x☐ Submission to government agencies that may monitor the study
- x☐ Publications and presentations
- ☐ Others

5. Expiration date or event

This authorization expires upon:

☐ The following date: _____

x☐ End of research study

☐ No expiration date

☐ Other: no end date, or upon request of participant_____

_____

6. Right to revoke authorization

I understand that I have a right to revoke this authorization at any time. My revocation must be in writing in a letter sent to the Principal Investigator at EFCC 408, DC 16.05 at University of Missouri, Columbia, MO, 65211. I am aware that my revocation is not effective to the extent that the persons I have authorized to use and/or disclose my PHI have already acted in reliance upon this authorization.

7. Statement that re-disclosures are no longer protected by the HIPAA Privacy Rule

I understand that my personal health information will only be used as described in this authorization in relation to the research study. I am also aware that if I choose to share the information defined in this authorization to anyone not directly related to this research project, the law would no longer protect this information. In addition, I understand that if my personal health information is disclosed to someone who is not required to comply with privacy protections under the law, then such information may be re-disclosed and would no longer be protected.

8. Right to refuse to sign authorization and ability to condition treatment, payment, enrollment or eligibility for benefits for research related treatment

I understand that I have a right not to authorize the use and/or disclosure of my personal health information. In such a case I would choose not to sign this authorization document I understand I will not be able to participate in a research study if I do not do so. I also understand that treatment that is part of the research project will be conditioned upon my authorization for the use and/or disclosure of my personal health information to and for use by the research team.

9. Suspension of right to access personal health information

I agree that I will not have a right to access my personal health information obtained or created in the course of the research project until the end of the study.

10. If I have not already received a copy of the University of Missouri Healthcare Privacy Notice, I may request one. If I have any questions or concerns about my privacy rights I should contact, the HS Privacy Officer at 573-882-9054.

11. Individuals' signature and date

I certify that I have received a copy of the authorization.

_____ _____

Signature of Research Participant Date

_____ _____

Research Participant's Legally Authorized Representative Date

_____

Describe Representative Authority to Act for the Participant

VITA

Yaowarat Matchim was born October 25, 1971, in Nakhon Si Thammarat Province, Thailand. After attending schools in Nakhon Si Thammarat, she received the following decrees: B.N.S. (1994) and M.S. in Public Health (1999) from Mahidol University, Bangkok, Thailand, and Ph.D. in Nursing from the University of Missouri-Columbia (2010). She has experience in the area of medical nursing. She presently works as an assistant professor on the Faculty of Nursing, Prince of Songkla University, Hat Yai, Songkhla, Thailand.