

# Women, Stress and Heart Health: Mindfulness-Based Stress Reduction and Cardiovascular Disease

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Psychological stress including depression and anxiety are independent risk factors for cardiovascular disease morbidity and mortality, especially in women. Emotional regulation plays a mediating role in the development of depression and physical illness, and can alter resting physiologic responses associated with the stress response. Mindfulness-based stress reduction (MBSR) is a structured group program that employs mindfulness meditation to alleviate suffering associated with physical, psychosomatic, and psychiatric disorders. MBSR was originally developed for the management of chronic pain, which is now used widely to reduce psychological morbidity associated with chronic illnesses and to treat emotional and behavioral disorders. In cardiovascular disease, MBSR may be helpful for controlling several risk factors for coronary heart disease such as hypertension, type 2 diabetes mellitus, dyslipidemia, oxidative and psychosocial stress, obesity, and smoking, and improvements in submaximal exercise responses and heart rate variability. Although the most effective mode of stress reduction therapy is yet to be established, increasing recognition is being given to MBSR therapy.

**Key Words:** cardiovascular disease, Mindfulness based stress reduction therapy, relaxation, Stress, Women

Cardiovascular disease is the leading cause of death in both women and men. Although the number of cardiovascular deaths has declined in men, it has actually increased in women over the past decade. And this unfortunate trend is primed to continue, because not only is our population aging, but it is being ravaged by the epidemics of obesity, metabolic syndrome, and diabetes— all of which disproportionately affect women.<sup>1</sup> Clearly, this is an important issue, however the misperception persists that cardiovascular disease does not affect women seriously, even though

women account for almost 50% of deaths annually.<sup>2</sup> Converging evidence from experimental and epidemiological studies indicates that there is an association between chronic psychological distress and cardiovascular disease.<sup>3</sup> Many studies have produced evidence to indicate that women report more psychologic distress than men.<sup>4,5</sup>

The cardiovascular system is thought by many researchers to be the primary target end organ for the stress response.<sup>6</sup> Psychological stress can cause endothelial distress and dysfunction in hu-

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mans,<sup>7</sup> animals<sup>8</sup> and psychological risk factors such as anxiety and depression have been associated with coronary artery disease (CAD). Stress can have an impact on risk factors for disease, such as high blood pressure (BP), physical inactivity, and being overweight. Enhanced sympathetic nerve activity (SNA) plays a major role in the development of atherosclerosis and endothelial dysfunction. Chronic physical pain and mental stress may enhance SNA, and alter the function of the sympathetic nervous system (SNS). Disequilibrium of the autonomic nervous system increases SNS activity at rest, along with a deficiency of SNS-mediated responses to certain stimuli such as postural change or exercise.<sup>9</sup> In this review, we show the link between stress and heart disease, and outline the impact of stress reduction on cardiovascular disease.

## STRESS AND HEART DISEASE

The link between psychosocial factors such as stress and CAD has drawn significant attention. Chronic stressful stimuli such as work stress, marital stress, caregiver strain, low social support, and low socioeconomic status have been linked to an increased risk of coronary artery disease and other adverse cardiac events.<sup>10</sup> There is also evidence that emotional stressors can act as triggers for acute cardiovascular events.<sup>11</sup> Moreover, the cultural construction of hwabyung, a Korean culture-bound syndrome, describes the occurrence of bodily symptoms in response to distressed emotions associated with the Korean way of perceiving and to intolerable and tragic life situations.

Hwabyung usually occurs in middle-aged or older women and provides a way of conceptualizing and resolving emotional distress through somatic symptoms, such as chest tightness and palpitation, among elderly Korean women.<sup>12,13</sup> Previously, we demonstrated that myocardial longitudinal deformation and endothelial function is reduced in patients with chronic emotional stress, as assessed by two-dimensional strain echocardiography and brachial flow mediated dilatation.<sup>14</sup> In this study, the decreases in LV function and endothelial function were independently related to the severity of stress intensity as determined by the validated questionnaire, SCL-90-R. Recently, in a multi-center prospective cross-sectional survey of 163 Korean women with chest pain, we evaluated the presence of depression using the Beck Depression Inventory (BDI) and Lee and Rhee Depression (LRD) scales.<sup>15</sup> In this study, we demonstrated that depression is associated with a prolonged corrected QT (QTc) interval, CAD, and coronary vasospasm in female patients with chest pain, suggesting a possible mechanism by which depressive mood may be linked with coronary endothelial dysfunction and atherosclerosis. Regarding these results, emotional regulation may play a mediating role in the development of depression and physical illness.

## STRESS REDUCTION AND MINDFULNESS-BASED STRESS REDUCTION (MBSR)

We conducted a narrative review of the major evidence concerning the relationship between



emotional regulation and depression. The employment of adaptive emotional regulation strategies may enable the reduction of stress-elicited emotions leading to physical disorders. In contrast, dysfunctional emotional regulation strategies such as rumination and emotion suppression appear to be influential in the pathogenesis of depression and physiological disease. More specifically, the evidence suggests that depression and rumination impair ability to process negative information and hypothalamic pituitary adrenal axis over-activation with higher rates of cortisol production. Understanding the factors that govern the variety of health outcomes that different people experience following exposure to stress has important implications for the development of effective emotion-regulation interventional approaches (e.g., mindfulness-based therapy, emotion-focused therapy, and emotion regulation therapy).<sup>16</sup> Actually, it is necessary to practice and to understand this concept experientially rather than conceptually.<sup>17</sup> Researchers have shown that the practice of relaxation techniques such as yoga, Transcendental Meditation, and Benson's relaxation response<sup>18</sup> alters resting physiologic responses associated with the stress response.

Mindfulness-based stress reduction (MBSR) is a structured group program that employs mindfulness meditation to alleviate suffering associated with physical, psychosomatic and psychiatric disorders. This, a well-delineated 8-week meditation program, nonreligious and nonesoteric, is

based upon a systematic procedure to develop enhanced awareness of moment-to-moment experience of perceptible mental processes.<sup>19-21</sup> Mindfulness is defined as the capacity to intentionally be in the present moment without judgement,<sup>22</sup> and this approach assumes that greater awareness will provide more veridical perception, reduce negative affect and improve vitality and coping. MBSR incorporates the principles of mindfulness meditation, breathing exercises, and yoga. Since the MBSR program, known as an Eastern psychological practice method, was first introduced to the medical field by Kabat-Zinn in 1980,<sup>22</sup> it has been discussed as a new treatment for diverse chronic diseases and anxiety, depression, and other psychological disorders. Meditation mediates physiological changes by inducing the relaxation of the parasympathetic nerves that have a potent reaction to stress caused by the excitation of the sympathetic nervous system. In addition, during the practice of meditation, the brain wave referring to the most awakened cognitive state, the theta wave, is observed abundantly, and has been reported to increase not only cognitive function but also physical performance capacity. This program is designed to allow meditation to become routine by the end of 8-weeks of gradual training, and thus to decrease physical and psychological disorders such as depression, anxiety, and sleep disorders by resolving stress experienced during daily life and reducing tension. It has been reported that after the completion of the 8-week program, medical physical syndromes and psy-



chological syndromes such as anxiety, depression, and hostility, that were observed at the beginning of the program were markedly decreased.

## **MBSR AND CHRONIC DISEASE**

In the last two decades, a number of research reports seemed to support many of these claims. Previous studies suggest that MBSR may help a broad range of individuals to cope with their clinical and nonclinical problems.<sup>23,24</sup> The impact of a MBSR program on improving well-being (i.e., relaxation states and related positive emotions) in a sample of 42 physicians over a period of one year (an 8-week MBSR program, with an additional 10-month maintenance period) showed significant improvements in levels of mindfulness and relaxation in favor of the experimental group compared with the control group.<sup>23</sup> Interestingly, the improvements of positive emotional states, such as at ease/peace, renewal, energy, optimism, happiness, acceptance, and even transcendence that were obtained after eight weeks were significantly increased at the end of the maintenance period after a year, especially those for mindfulness and positive energy.

Several studies have shown that MBSR has significant effects on chronic conditions, including heart disease, and fibromyalgia. Fibromyalgia, a chronic pain syndrome, is often accompanied by psychological distress and increased basal sympathetic tone. Because the effect of chronic stress on the cardiovascular system is unknown, studies of patients with fibromyalgia could provide useful

information about the impact of chronic negative psychological symptoms with SNS activation. We previously showed that chronic pain exerts a negative effect on endothelial function in fibromyalgia patients,<sup>25</sup> which is associated with an increased risk of vascular stiffness,<sup>26</sup> and chronic emotional or physical stress in fibromyalgia patients might reduce myocardial longitudinal deformation.<sup>27</sup> Regarding stress reduction in fibromyalgia, a previous report showed that MBSR reduced depressive symptoms in patients with fibromyalgia with gains maintained at two months follow-up.<sup>28</sup> Basal SNS activity was reduced following MBSR treatment, and the beneficial effect of MBSR was shown in the reduction of negative psychological symptoms and attenuation of SNS activation associated with fibromyalgia.

## **MBSR AND CARDIOVASCULAR DISEASE**

MBSR program participation was associated with enhanced quality of life and decreased stress symptoms, altered cortisol and immune patterns consistent with less stress and mood disturbance, and decreased BP.<sup>29</sup> Significant reductions were observed in symptoms of anxiety and depression, perceived stress, BP, and body mass index (BMI) in patients with CAD of the MBSR group after the completion of intervention assessment. At 3-month follow-up, therapeutic gains were maintained in patients in the MBSR group.<sup>30</sup> MBSR also showed larger pre-to-post-intervention decreases in overall systolic and diastolic BP compared to the control group after controlling for



age, sex, BMI, and beta-blockers. In addition, the MBSR group exhibited smaller systolic and diastolic BP stress-related changes from pre- to post-intervention.<sup>31</sup>

Additionally, heart rate significantly decreased for the intervention group and the change was maintained for one year after the beginning of the treatment.<sup>24</sup> Among MBSR programs, interoception, a conscious perception of body signals and mindfulness, is a meditation practice that encourages individuals to focus on their internal experiences such as bodily sensations, thoughts, and emotions. MBSR showed no influence relevant to meditation practice in cardiac interoception or in most related social cognition measures. These negative results could be partially due to the fact that awareness of heartbeat sensations is not emphasized during mindfulness/vipassana meditation and may not be the best index of the awareness supported by the practice of meditation.<sup>32</sup> Recently, participation in an 8-week MBSR program was shown to improve frequency domain parameters of heart rate variability (HRV) during meditation, suggesting improved sympatho-vagal balance.<sup>33</sup> MBSR improved autonomic balance with reduced sympathetic and increased parasympathetic influence compared to controlled respiration alone, and we suggest that MBSR could be a useful adjunct in the management of conditions with reduced HRV, such as acute myocardial infarction and heart failure.<sup>34</sup>

Metaanalysis to determine the effectiveness of MBSR and mindfulness-based cognitive therapy

(MBCT) on psychological and physical outcomes for people with vascular disease showed evidence of reductions in stress, depression, and anxiety by MBSR/MBCT intervention.<sup>35</sup> In vascular disease, pilot and observational studies of MBSR and MBCT intervention have been associated with improvements in perceived health, quality of life and physiological responses in stroke survivors, and in reductions of patient reported diabetes-related distress.<sup>36</sup> MBSR has also been associated with lowered BP and better glycemic control in patients with diabetes.<sup>37</sup> At present, there are no Korean data except one study of patients showing anxiety and depression after SAH treatment, which observed reductions in depression symptoms and physiological reactions after surgery, suggesting that the application of MBSR may be considered as a viable new tool for improving the quality of life of patients after surgery.<sup>38</sup> However, there are several limitations of the reported studies, and larger studies are needed to confirm these findings.

## **MBSR, CARDIOVASCULAR DISEASE AND WOMEN**

There are some reports of gender differences in response to MBSR. Female patients with CHD showed significant differences in breathing patterns, physical functioning, and submaximal exercise responses during exercise following the 8-week MBSR program without differences in resting levels of stress hormones.<sup>39</sup> Another study showed that female participants exhibited significantly larger decreases in diastolic BP during



meditation, whereas men had greater increases in cardiac output during meditation, which indicate similarities and differences in physiological responses to body scan meditation and other relaxing activities.<sup>40</sup> Recently, we examined the effect of an MBSR program on symptoms of anxiety and depression, perceived stress, myocardial and endothelial function in 20 female patients with microvascular angina. Interventions were carried out at an outpatient clinic, and female patients who participated in an 8-week MBSR program showed significantly reduced stress indexes and improved parameters of flow-mediated vasodilatation (unpublished data).

## CONCLUSION

Heart disease accounts for over a quarter of all global deaths, and depression, anxiety, and psychological stress are independent risk factors for cardiovascular disease morbidity and mortality. In recognition of this, many guidelines for conditions such as cardiac rehabilitation and hypertension include stress management as a part of recommended therapy. Equipping patients with skills and coping strategies to help reduce or manage perceived psychological stress may represent an important secondary prevention intervention. MBSR is an 8-week structured program originally developed for the management of chronic pain that is now used widely to reduce psychological morbidity associated with chronic illnesses and to treat emotional and behavioral disorders. In cardiovascular disease, pilot and observational

studies of MBSR intervention suggest that MBSR may be helpful in controlling several risk factors for coronary heart disease like hypertension, type 2 diabetes, dyslipidemia, oxidative and psychosocial stress, obesity and smoking. MBSR is also associated with improvements in submaximal exercise responses and heart rate variability. Although the most effective mode of stress reduction therapy is yet to be established, increasing recognition is being given to MBSR therapy, especially in women who are susceptible to stress.

## CONFLICT OF INTEREST STATEMENT

No conflict of interest.

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### **Peer Reviewer's Commentary**

Mindfulness-Based Stress Reduction (MBSR) is a structured group program that employs mindfulness meditation to alleviate suffering associated with physical, psychosomatic, and psychiatric disorders. MBSR was originally developed for the management of chronic pain, which is now used widely to reduce psychological morbidity associated with chronic illnesses and to treat emotional and behavioral disorders. MBSR will be a meaningful results if you research the impact of brain waves.

(Editorial Board)