



Contents lists available at ScienceDirect

## Journal of Psychosomatic Research



## Mindfulness-based cognitive therapy (MBCT) for multiple chemical sensitivity (MCS): Results from a randomized controlled trial with 1 year follow-up

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## ARTICLE INFO

## Article history:

Received 14 January 2015

Received in revised form 29 June 2015

Accepted 30 June 2015

Available online xxxxx

## Keywords:

Mindfulness-based cognitive therapy

Multiple chemical sensitivity

Randomized controlled trial

## ABSTRACT

**Objective:** Multiple chemical sensitivity (MCS) is a medically unexplained condition characterized by symptoms from multiple organ systems following the perception of common odorants. The condition can cause severe functional impairment for afflicted individuals. The aim of this study was to assess the effects of mindfulness-based cognitive therapy (MBCT) for individuals with MCS.

**Methods:** The intention-to-treat sample (ITT) included 69 individuals who had been randomized to either MBCT or treatment as usual (TAU). The primary outcome measure was the Quick Environmental Exposure and Sensitivity Inventory (QEESI), which measures the following aspects of MCS: impact of MCS on daily life, symptoms, and reactions following chemical exposures. Secondary outcome measures included the Brief Illness Perception Questionnaire (BIPQ) and the anxiety and depression subscales of the symptom checklist 92 (SCL-92). Participants were assessed at baseline and post treatment, and at follow-up periods of 6- and 12-months.

**Results:** We found no effect of MBCT on the primary outcome, nor did we find an effect on levels of depression or anxiety. We did, however, find positive changes in illness perceptions, which were sustained at 12-month follow-up. Dropout rates were low, suggesting MBCT was well received and regarded as an acceptable intervention by individuals with MCS.

**Conclusions:** Overall, these results suggest that MBCT does not change overall illness status in individuals with MCS, but that MBCT positively changes emotional and cognitive representations. Possible explanations for these results are discussed.

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## Introduction

Multiple chemical sensitivity (MCS), also known as idiopathic environmental intolerance, is a medically unexplained condition characterized by symptomatic reactions to a perceived exposure to common odorous chemicals, such as fragranced products and freshly printed newspapers or magazines [2]. A distinct symptom pattern has not been established, as symptoms typically vary between afflicted individuals, adding difficulties to the formulation of a case definition. Nevertheless, symptoms from muscles and joints, extreme fatigue, upper airway symptoms as well as symptoms originating from the central nervous system (CNS), such as headache, dizziness, and confusion, are

frequently reported among individuals who attribute symptoms to airborne chemicals [3,17], and the condition is more commonly reported in women than in men [2,6,7]. A Danish study from 2008 reported that an estimated 0.5% of the adult Danish population experience symptoms attributed to airborne chemicals causing them to make adjustments to both working life and social life [2], making MCS both a relatively common and disabling problem. There are currently no evidence-based treatments for MCS.

While the etiology and pathogenesis of MCS is still unclear, there is no evidence to suggest that MCS is explained by a toxicological response to common chemical odorants [1,9]. Instead, individual susceptibility factors such as stress, subjective health complaints, and limited social support have been found to be risk factors in the development of MCS [10]. High degrees of symptomatic overlap and comorbidity between MCS and other medically unexplained conditions, such as chronic

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fatigue syndrome and fibromyalgia, have been reported in some studies [5,15]. This raises the possibility that these conditions might be fueled by common mechanisms, such as central sensitization, which has been reported in individuals with MCS [32]. Studies from health psychology have shown that illness perceptions are particularly influential in patients with medically unexplained symptoms in terms of number of symptoms, seriousness, and chronicity [21], and compared with patients with similar physical disability with known organic pathology, patients with medically unexplained symptoms have been found to express a higher degree of impairment in relation to carrying out day-to-day roles and socializing [21]. Whether negative illness perceptions uniquely contribute to the etiology of MCS is unknown, although there is some evidence suggesting that individuals with MCS have higher levels of modern health worries, which could theoretically contribute to the amplification of bodily signals into symptoms [36].

In recent years, mindfulness-based interventions (MBIs), most noteworthy mindfulness-based stress reduction (MBSR), have gained popularity for a great variety of physical and mental conditions. Core mindfulness themes include increasing present moment awareness and enhancing acceptance of circumstances in one's life that may be difficult or impossible to change, particularly with regard to chronic physical illness and psychological suffering [16]. In a more recent development, mindfulness has been combined with elements from cognitive behavioral therapy, labeled mindfulness-based cognitive therapy (MBCT), and has been used in the treatment for a variety of conditions, such as health anxiety [34], symptoms of anxiety and depression among cancer patients [37], chronic fatigue syndrome [26], as well as current depression [19] and anxiety disorder [33]. A steadily increasing number of studies have assessed the potential of MBIs for various medically unexplained conditions. A recent meta-analysis, although lacking power, reported a small to moderate positive effect of MBIs in reducing pain and symptom severity and in reducing levels of anxiety and depression [18]. Although more research is clearly needed, these findings suggest that MBIs have a promising potential in the treatment of these conditions.

So far, only two studies have attempted to use an MBI in the treatment of MCS. Our group conducted a pilot trial assessing the effects of MBCT on psychological distress and illness perceptions in individuals with MCS. The study did not find a significant effect of MBCT in terms of reducing symptoms of anxiety or depression, however, a borderline significant effect was found on a global score of psychological distress, and coupled with positive verbal feedback provided by several of the participants it was concluded that a larger trial could be considered. The second study included participants who presented with several functional somatic syndromes, including MCS, and found that an adapted MBSR program was associated with improved mental health in addition to a statistically significant within group reduction of somatic symptoms [27]. In spite of these promising results, knowledge is still lacking with respect to the potential of MBIs in reducing the perceived sensitivity to odorous chemicals in individuals with MCS. This study therefore aimed at assessing the potential of an adapted MBCT program as a treatment for MCS.

## Methods

The study had obtained approval from the regional ethics committee and was carried out between September 2011 and May 2012 with follow-up assessments continuing until May 2013.

### Objectives

The primary objective of the study was to examine the effect of MBCT on MCS. Secondary objectives included an assessment of whether the MBCT intervention would be associated with more positive cognitive and emotional illness perceptions along with reduced levels of anxiety and depression. The study was conducted as a pragmatic

parallel groups design, comparing the MBCT program with treatment as usual (TAU).

### Participants

Participants were 69 individuals who were recruited by means of referral from their general practitioner, through newspaper ads, and by contacting individuals registered at the Danish Research Centre for Chemical Sensitivities who had agreed to be contacted for future research projects. Potential participants were interviewed by telephone and screened for eligibility. To be eligible, participants had to be between 18 and 65 years of age, have signed a written informed consent form, and fulfill the following criteria for MCS: 1) The condition had lasted for at least 6 months causing significant lifestyle or functional impairments, 2) there were reproducible CNS symptoms, 3) there was at least one symptom from another organ system, 4) the symptoms occurred in response to low levels of exposure to 5) multiple unrelated chemicals, and 6) symptoms were improved or resolved when these inciting chemicals were removed [11,17]. Exclusion criteria included psychotic or bipolar disorders, suicidal ideations, drug or alcohol abuse, and previous participation in an 8-week MBCT or MBSR program.

Participants who fulfilled the study criteria were then invited to undergo a thorough assessment by means of the Schedules for Clinical Assessment in Neuropsychiatry (SCAN), which is a semi-structured interview designed to assess and classify psychopathology and behavior associated with major psychiatric disorders, as well as containing a comprehensive list of questions concerning somatic symptoms from different organ systems. We were therefore able to assess the participants in terms of psychiatric comorbidity and the comorbid functional somatic syndromes that could be identified by SCAN, using the algorithms suggested by Fink and Schroder [12].

### Sample size and power

Sample size was calculated on the basis of the life impact scale (LIS) of the primary effect measure, the Quick Environmental Exposure and Sensitivity Inventory (QEESI). A recent study evaluating a Danish translation of the QEESI showed that a sample consisting of individuals with MCS had a mean score of 61.5 and a standard deviation of 24.3 on the LIS [30,31]. We considered a 25% reduction of the LIS score to be a clinically relevant improvement, which would amount to a Cohen's  $d$  of 0.61, regarded as a moderate effect size. Our sample size estimation showed that a total of 82 participants were required to detect such a difference with a power of .80.

### Randomization

Randomization was carried out in blocks of 16–20 individuals, who were randomized in equal numbers to MBCT or TAU. This was regarded as an adequate number of participants to start an MBCT group. The randomization was conducted by a researcher who was not otherwise involved in the trial. The random allocation sequence was generated by means of a computer program, and the research team was blinded to the allocation process. Following the randomization, the first author informed the participants about the results of the allocation by telephone.

### Measures

The *Quick Environmental Exposure and Sensitivity Inventory* (QEESI) has been developed as a screening instrument for MCS designed to facilitate history-taking from individuals who report chemical intolerance [20]. We used the following 3 scales: Symptom Severity, Chemical Exposures, and Life Impact, each containing 10 items and producing a score ranging between 0 and 100. The Symptom Severity Scale covers 10 groups of symptoms, e.g. pain in muscles or joints, mucosal and

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