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Health and Disability

Mindfulness-based cognitive therapy to treat multiple chemical sensitivities: A randomized pilot trial

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Multiple chemical sensitivities (MCS) is a medically unexplained and socially disabling disorder characterized by negative health effects attributed to exposure to common airborne chemicals. Currently, there is no evidence-based treatment. The objectives of the study were to assess the feasibility of an 8-week mindfulness-based cognitive therapy program (MBCT) for adults with MCS and to evaluate possible effects on psychological distress and illness perception. The study design was a randomized clinical trial. The MBCT programme comprised 8 weekly sessions of 2½ hours. Forty-two adults were screened for eligibility and 37 were included. Mean age of the participants was 51.6 years, 35 (94.6%) were female and 21 (56.8%) were unemployed. Measures of psychological distress and illness perceptions were assessed at baseline, 4 weeks, 8 weeks and at 3 months follow-up. No significant differences in effect measures were found between the groups. However, those who completed the MBCT program generally reported benefiting in terms of improved coping strategies and sleep quality. The positive verbal feedback from the participants in the MBCT group suggests that a larger randomized clinical trial on the effect of MBCT for MCS could be considered.

Key words: Multiple chemical sensitivities, mindfulness, MBCT, randomized trial.

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INTRODUCTION

Multiple chemical sensitivities (MCS), is a disorder characterized by reports of non-specific symptoms from various organ systems attributed by the individual to exposure to common airborne chemicals (Graveling, Pilkington, George, Butler & Tannahill, 1999). In general, the reported symptoms are attributed to previous chemical exposures and recur on a subsequent exposure to the same or structurally unrelated chemicals at levels normally considered to be non-toxic (Graveling *et al*., 1999). Symptoms from the central nervous system (CNS) are characteristic (Lacour, Zunder, Schmidtke, Vaith & Scheidt, 2005) and a predictor of symptom severity (Berg, Linneberg, Dirksen & Elberling, 2009). Other symptoms include airway and mucosal symptoms, gastrointestinal symptoms and muscle and joint pain (Graveling et al., 1999; Berg, Linneberg, Dirksen & Elberling, 2008).

The pathophysiology of MCS is unexplained. Central sensitization, that is, altered function of the nociceptive nervous system, has been suggested as a mechanism in MCS, which is supported by recent findings of experimentally induced secondary hyperalgesia after intradermal injection of capsaicin (Holst, Arendt-Nielsen, Mosbech & Elberling, 2011), and signs of increased sensitization after repeated chemical exposure accompanied by alterations in central cognitive responses (Andersson, Bende, Millqvist & Nordin, 2009). In terms of risk factors, results from a recent population-based prospective study suggest that increased levels of stress and strain may be risk factors in the development of chemical intolerance reactions (Eek, Karlson, Osterberg & Ostergren, 2010). Evidence also points to associations between MCS and symptoms of psychological distress, that is, depressive symptoms, negative affect and anxiety (Bailer, Witthoft, Bayerl & Rist, 2007; Caccappolo-van, Kelly-McNeil, Natelson, Kipen & Fiedler, 2002; Osterberg, Persson, Karlson, Carlsson & Orbaek, 2007; Skovbjerg, Zachariae, Rasmussen, Johansen & Elberling, 2010) and psychiatric disorders, that is, depression, anxiety disorders and somatoform disorders (Bailer, Witthoft, Paul, Bayerl & Rist, 2005; Bell, Peterson & Schwartz, 1995; Black, 2000; Bornschein, Forstl & Zilker, 2001; Bornschein, Hausteiner, Zilker, Bickel & Forstl, 2000; Eis, Helm, Muhlinghaus *et al*., 2008; Simon, 1994).

Avoiding exposure to potential symptom-eliciting chemical triggers is a characteristic coping response in affected individuals (Gibson, Elms & Ruding, 2003; Lipson, 2001; Skovbjerg, Brorson, Rasmussen, Johansen & Elberling, 2009), including avoiding public places and transportation, restricting social activities and, in some cases, occupational changes. MCS may thus be associated with poor quality of life and in severe cases, social isolation and job loss. As such, an effective evidence-based treatment is highly needed. Taking the poly-symptomatology into consideration, as well as the commonly reported association with psychological distress, a psychosocial intervention may prove effective. Mindfulness-based cognitive therapy (MBCT) is a group skills-based training approach developed as a means to prevent relapse of depressive episodes (Segal, Williams & Teasdale, 2002). Mindfulness involves particular qualities of attention and awareness that are developed and cultivated through meditation techniques (Baer, 2003; Kabat-Zinn, 2003). MBCT is partly based on the mindfulness-based stress reduction program (MBSR), developed by Jon Kabat-Zinn and colleagues, and partly on cognitive ther-

apy for depression (Segal *et al*., 2002). The latter particularly expressed through the aspect of ''decentering'', meaning not accepting the content of thoughts as facts and not identifying with thoughts (Segal *et al*., 2002). Effects of mindfulness-based treatments for chronic medical conditions and medically unexplained disorders are increasingly being studied and although more randomized clinical trials are needed, a growing amount of evidence supports the effect of this approach (Hofmann, Sawyer, Witt & Oh, 2010; Fjorback, Arendt, Ornbøl, Fink & Walach, 2011).

The objectives of this pilot study were to assess the feasibility of adherence to an 8-week MBCT program for adults with MCS, and to evaluate initial and possible treatment effects on measures of psychological distress and illness perception.

MATERIALS AND METHODS

Study design

The pilot study was designed as a randomized clinical trial on the effect of MBCT versus treatment as usual (TAU), that is, no treatment. Forty-two adults were screened for eligibility and 37 were included. Eligible participants stratified by occupational status (i.e., employed/not employed) were randomized to either intervention (MBCT) or TAU.

Participants

Participants were invited on the basis of self-reported symptoms attributed to common airborne chemicals or physician diagnosed MCS. Invitations to participate were sent to: (1) participants who had responded to a survey on the prevalence and consequences of self-reported symptoms attributed to common airborne chemicals in a Danish general population conducted at the Danish Research Centre for Chemical Sensitivities (4). Only respondents who had reported adjustments of social life and/or occupational conditions due to symptoms and who consented to be contacted again were invited to participate (n = 87), (2) adults registered at the Danish Research Centre for Chemical Sensitivities because of self-reported symptoms attributed to common airborne chemicals (n = 62), and (3) adults who had received a diagnosis of chemical sensitivities either at the Copenhagen University Hospital, Rigshospitalet, or at Hamlet, Private Hospital, Denmark during 1 January 1990–1 January 2006 (n = 19) by the same ear-nose-and throat (ENT) specialist.

Eligibility criteria

Inclusion criteria:

- Age > 18 years
- Currently living on Zealand, Denmark
- Self-reported symptoms and lifestyle adjustments attributed to exposure to common airborne chemicals, or physician diagnosed MCS.

Exclusion criteria:

- Current diagnosis of severe depression and/or psychotic disorders
- Current medical treatment with psychotropics
- Alcohol or drug abuse
- Previous participation in an MBCT program

Recruitment and signed informed consent

Eligible participants received a letter inviting them to participate in the present study. Detailed written information on the study was enclosed. Participants who agreed to participate received verbal information about the study and were requested to sign a written consent form.

Randomization procedure

Participants stratified by occupational status (i.e. employed/not employed) were randomized to either: (1) MBCT program or (2) TAU. The randomization procedure was carried out at the Danish Research Centre for Chemical Sensitivities. An independent member of staff with no part in the study decided on which group (even or uneven numbers) would receive MBCT and which would receive no intervention.

Blinding

The study was conducted without blinding after randomization, since participants were aware of group affiliation.

Baseline characteristics

Characteristics of the two groups are shown in Table 1. The mean age of all the study participants was 51.6 years. Table 1 show that the randomization was successful. The majority of study participants were women and the mean duration of symptoms was 13.8 years.

Description of intervention

The MBCT program. A psychologist and a consultant psychiatrist both with extensive experience in mindfulness were in charge of the MBCT program. The program included 2½ hours of group training once a week for 8 weeks and was carried out according to the manual developed by Zindel V. Segal, J. Mark G. Williams and John D. Teasdale (Segal *et al*., 2002). In addition, participants were encouraged to practice at home for up to 45 mins per day, 6 days a week during the entire course. Guided CD instructions were provided for home practice.

Treatment as usual. The Danish Healthcare system has no formal clinical guidelines for the management of people who report MCS. Participants who were randomized to ''TAU'' were encouraged to continue as usual and seek medical advice according to their needs.

Outcome measures

Effects of the MBCT program were estimated based on individual scores on the following psychometric scales:

Symptom Checklist-92 (SCL-92). SCL-92 evaluates psychological distress and psychopathological symptoms on nine dimensions: (1) somatization, (2) obsessive-compulsive, (3) interpersonal sensitivity, (4) depression, (5) anxiety, (6) aggression, (7) phobic fear, (8) paranoia and (9) psychosis. Responses are given on a five-point Likert scale (scores 0–4). At the global level, psychological distress can be evaluated by the Global Severity Index (GSI), which is the mean score of all items. The SCL-92 has been validated in a general Danish population and normative data have been established (Olsen, Mortensen & Bech, 2004, 2006).

The Brief Illness Perception Questionnaire (Brief IPQ). An individual may develop a cognitive representation of illness based on symptoms,

Table 1. *Participant characteristics*

	MBCT group	Control group	Total
Females (*n*/%)	17 (100)	18 (90)	35 (95)
Age/years (mean/SD)*	50.1 (5.9)	53.0 (11.2)	51.6 (9.2)
Duration of MCS symptoms (years)	13.1	14.4	13.8
Unemployed (*n*/%)	9 (53)	12 (60)	21 (57)

pre-existing knowledge and input from others, as suggested by the ''common sense model'' (Leventhal, Benyamini, Brownlee *et al*., 1997), where illness representations are regarded as key determinants of the behavior directed at managing the illness. Furthermore, it has been suggested that illness perception is influential in patients presenting with medically unexplained symptoms in terms of onset, persistence of symptoms and degree of disability (Moss-Morris & Chalder, 2003). The Brief IPQ is a nine-item scale designed to assess cognitive and emotional perceptions of illness according to the cognitive dimensions described by Leventhal *et al*. (i.e., influence on daily living, duration and severity of illness, understanding of the cause of illness, control and emotional impact). Responses are given on a continuous linear scale that ranges from one to ten (Broadbent, Petrie, Main & Weinman, 2006).

Participants were followed for 5 months with repeated measures at:

- Baseline
- Four weeks after start of MBCT course
- End of MBCT course
- Three months after ending the MBCT course.

Statistics

Sample size. Calculation of sample size was based on an estimated 35% reduction in scores on the *depressive dimension* of the SCL-92. With an 80% power and a significance level of 0.05 the estimated sample size for each group was $n = 22$.

Data analyses. Group affiliation, that is, intervention or control, was concealed for the statistician who performed the statistical analyses. Data were analyzed using SPSS, version 15.0 for Windows and SAS version 9.1, level of significance was set at 0.05.

Descriptive statistics for the two groups were generated. In the statistical analyses of each outcome measure (Y) the mixed model repeated measures method was applied (Storebø, Pedersen, Skoog *et al*., 2011; Winkel & Zhang, 2007). The model used is $Y = int + a{\cdot}t + b{\cdot}t^2 + c{\cdot}I + e{\cdot}I{\cdot}t + f{\cdot}I{\cdot}t^2$ where *int* is the intercept, I is a binary indicator of intervention, t is time (4, 8 and 20.6 weeks) used as a continuous variable, and a through f are coefficients to be estimated in the analysis. Thus we tested whether the mean level differed between the intervention groups, and whether the intervention had any effect on the two linear functions (that of t and that of t^2). The mixed model approach prevents bias if the data missing at random (MAR) assumption is fulfilled, that is, the missingness of values is related to the observed data only (Storebø *et al*., 2011). Since significant effects were not found, sensitivity analyses (32) were not conducted. The primary outcome of interest was SCL-92 depression score. Secondary and tertiary effect measures included SCL-92 anxiety and somatization scores, and scores on the brief IPQ, respectively. The effect measures were all inspected for normality and transformed as appropriate. Sequential hypothesis testing was applied, which is appropriate for polynomial models (33).

Covariance structure was chosen based on the Akaike criteria, that is, the covariance structure that best fits the full model was chosen. Because the intervals between consecutive time points were not of equal size, we chose the covariance structure among the following: unstructured, compound symmetric and the spatial power law, where the latter is a direct generalization of the autoregressive first order structure for equally sized time intervals. Covariates in the analyses included sex, job status and baseline scores on the effect measures. Analyses were performed both with and without the inclusion of covariates.

Approval

The study was approved by the Danish Data Protection Agency and the Research Ethics Committee of Copenhagen County. Signed informed consent was obtained from all participants. The study protocol was registered at ClinicalTrials.gov (ID H-C-2007-0088).

RESULTS

Recruitment and adherence

A total of 168 individuals were invited to participate in the study; 54 responded and were subsequently invited for an individual interview (Fig. 1); 12 declined and 42 were subsequently assessed for eligibility – 5 were ineligible due to active treatment with antidepressants ($n = 2$) and known allergies, that is, not MCS ($n = 3$). A total of 37 individuals were randomized; 17 were randomized to the MBCT intervention group, and 20 were randomized to the control group. The number of dropouts was significantly larger in the MBCT group ($n = 8/17$) than in the control group ($n = 3/20$, $p = 0.014$).

Evaluation of the MBCT program

Means and standard deviations of the primary, secondary and tertiary outcome measures in the intervention group and the control group are shown in Tables 2 and 3.

In total 25.2% of the values were missing (data not shown). Tables 2 and 3 suggest that there was no overall effect of the intervention, which was confirmed in the mixed models analyses (Table 4). Table 4 shows for each outcome measure the transformations necessary in the mixed model analyses and the covariance structures giving the best model fit. In all but one analysis (that of S01AS) there was no significant main effect of time or of time squared. All interactions between the intervention and time as well as time squared were insignificant. Thus by removing the insignificant terms, all models (except that of S01AS) included only the main effect of the intervention. The results of these analyses (with and without the baseline variable, the protocol specified stratification variable, and sex included) are shown in Table 4. It is seen that there was a significant effect of the intervention in terms of preoccupation with illness (question 4 on the IPQ) both with ($p = 0.01$) and without ($p = 0.02$) inclusion of the covariates. However, when adjusted for multiplicity (the number of

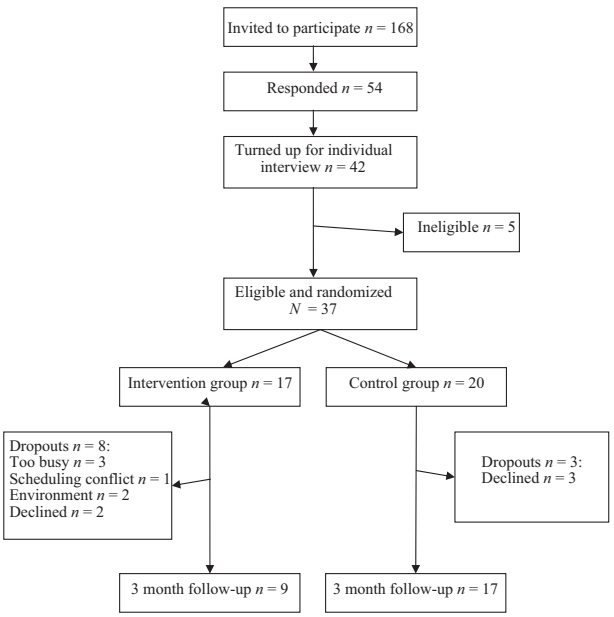

Fig. 1. Participant flow diagram.

Table 2. *Mean and SD of each of primary and secondary outcome measures in each intervention group at start, after 4 and 8 weeks, and after three month (20.6 weeks) following start of intervention*

Quantity		MBCT group			Control group		
SCL-92	Week	*N*	Mean	SD	*N*	Mean	SD
Depression	0.0	17	0.72	0.54	19	0.71	0.69
	4.0	11	0.57	0.45	16	0.66	0.67
	8.0	9	0.73	0.69	17	0.74	0.78
	20.6	8	0.81	0.68	17	0.61	0.73
Anxiety	0.0	17	0.40	0.28	19	0.50	0.64
	4.0	12	0.32	0.29	17	0.64	0.72
	8.0	10	0.31	0.29	17	0.58	0.72
	20.6	9	0.32	0.37	16	0.54	0.65
Somatization	0.0	17	0.72	0.62	19	0.92	0.61
	4.0	11	0.62	0.52	16	0.83	0.69
	8.0	10	0.78	0.82	17	0.79	0.59
	20.6	9	0.57	0.67	15	0.81	0.63
Global score	0.0	14	0.62	0.26	16	0.64	0.44
	4.0	11	0.53	0.26	14	0.76	0.43
	8.0	10	0.58	0.37	15	0.67	0.51
	20.6	9	0.52	0.34	14	0.64	0.44

Table 3. *Mean and SD of each of tertiary outcome measures in each intervention group at start and after 4, 8 and 20.6 weeks following start of intervention*

Quantity		Intervention group			Control group		
Brief IPQ	Week	*N*	Mean	SD	*N*	Mean	SD
S01A1	0.0	17	6.76	1.92	20	7.20	2.02
Effect on daily	4.0	12	7.00	2.26	19	6.74	1.66
living?	8.0	10	6.70	2.26	17	6.76	1.95
	20.6	9	7.44	2.19	17	6.88	2.00
S01A2	0.0	16	7.81	2.71	20	9.15	1.69
Course of illness?	4.0	12	7.83	2.41	18	8.94	1.73
	8.0	10	8.20	2.20	16	8.94	1.53
	20.6	9	8.67	2.24	17	8.82	1.70
S01A3	0.0	17	6.12	2.23	20	7.20	1.85
Severity of illness?	4.0	12	6.58	1.88	19	6.89	1.76
	8.0	10	6.40	2.32	17	7.06	1.85
	20.6	9	6.44	2.65	17	7.24	1.89
S01A4	0.0	17	5.41	1.87	20	6.10	2.08
Preoccupation	4.0	12	5.08	1.93	19	6.16	1.74
with illness?	8.0	10	4.90	2.51	16	6.63	2.03
	20.6	9	5.22	2.28	17	6.29	1.57
S01A5	0.0	16	7.06	2.32	20	6.00	3.85
Understanding	4.0	12	6.17	2.62	19	6.42	3.42
illness?	8.0	10	5.70	2.50	16	6.00	3.72
	20.6	9	6.33	2.74	17	6.06	3.53
S01A6	0.0	17	5.47	2.32	20	5.75	2.55
Emotional impact?	4.0	11	5.45	2.91	19	6.16	2.46
	8.0	10	5.80	2.39	16	5.88	2.53
	20.6	9	6.11	1.45	17	6.18	2.48
S01A7	0.0	17	4.88	3.00	19	4.95	2.64
Control?	4.0	12	4.50	2.88	18	5.06	2.67
	8.0	10	4.10	2.81	17	5.59	2.79
	20.6	9	4.22	2.49	16	4.38	2.47
S01A8	0.0	17	4.24	3.31	19	4.63	3.02
Effect of MBCT	4.0	10	3.00	2.71	17	4.65	3.41
	8.0	10	3.50	3.17	17	4.18	3.59
	20.6	9	2.22	2.28	17	3.65	2.85

significance tests performed) using, for instance, Holm's test (Holm, 1979), these results are no longer statistically significant.

DISCUSSION

This study was the first to test the feasibility of adherence to an 8-week MBCT program for adults with MCS in a randomized clinical trial, and to evaluate a possible effect on measures of psychological distress and illness perceptions. While no statistically significant effects were seen on either of the effect measures, the positive verbal feedback from the participants in the intervention group after the 3-month follow-up suggests some beneficial effects of MBCT in MCS.

The pathological mechanisms in MCS are currently unexplained, while the consequences may be severe in affected individuals. Although more research in the pathophysiology is needed before evidence-based treatment and prevention strategies can be recommended, current evidence points to the CNS in terms of central sensitization as a possible mechanism (Holst *et al*., 2011), and symptoms from the CNS, for example, concentration difficulties, exhaustion and dizziness, are characteristic of the disorder (Berg *et al*., 2009). Additionally, the commonly reported associations between MCS and psychological distress (Bailer *et al*., 2007; Caccappolo-van *et al*., 2002; Osterberg *et al*., 2007; Skovbjerg *et al*., 2010) as well as psychiatric disorders (Bailer *et al*., 2005; Bell *et al*., 1995; Black, 2000; Bornschein *et al*., 2000, 2001; Eis *et al*., 2008; Simon, 1994) taken together suggest that a psychosocial intervention targeting symptom management, stress reduction and cognitive style is highly relevant. In this study we used the MBCT manual developed by Segal *et al*. (2002). The effect of a mindfulness-based intervention program on psychological distress has been evaluated in one other study on MCS using a non-randomized design (Sampalli *et al.*, 2009). This study reported a significant decrease in psychological distress following participation in a mindfulness-based program compared with a waiting-list control group. However, selection bias may have been a problem due to the study design. In general only very few treatment studies on MCS have been published. One case study reported a successful treatment outcome using a therapeutic approach, combining psychological desensitization and pharmacological treatment with selective serotonin reuptake inhibitor (Stenn and Binkley, 1998). Overall, there is a great need for randomized trials on treatments for MCS.

In the present study no overall statistically significant effects were seen on either of the measures of psychological distress or illness perceptions, which may be a question of the study not having sufficient power. Only a borderline significant result was seen for the global score of the SCL-92 and for question four, that is, preoccupation with illness, on the IPQ (Table 4). These are most likely random findings since no other significant effects on either effect measures were found. Effects of mindfulness-based treatments for chronic medical conditions and medically unexplained disorders are increasingly being studied and although more randomized clinical trials are needed, there is some evidence to suggest that mindfulness-based interventions are efficacious on

Table 4. *P*-values of main effect of intervention group without and with covariates[a] included in the analysis

Quantity	Without covariates included	With covariates included	Transformation of quantity	Covariance structure chosen
SCL92Depression	0.87	0.54	Square root	CS[b]
SCL92Angst	0.26	0.21	Square root	Power[c]
SCL92Somatizering	0.33	0.96	Square root	CS
SCL92Global	0.36	0.08	Square root	CS
S01A1	0.82	0.94	Square root	Power
S01A2	0.24	0.52	None	UN[d]
S01A3	0.32	0.39	None	CS
S01A4	0.02	0.01	None	CS
S01A5	0.77	0.11	None	CS
S01A6	0.46	0.15	None	CS
S01A7	0.90	0.94	None	Power
S01A8	0.30[e]	0.58[e]	None	CS

[a] Baseline value, indicator of sex and protocol specified stratification variable (indicator of employment, employed? yes/no).
[b] Compound symmetric.
[c] Power rule.
[d] Unstructured.
[e] Main effect of time ($0.01 < p < 0.05$), thus the final model includes time and group.

mental health and in disease management to improve quality of life (Fjorback *et al*., 2011). Despite the need for more randomized clinical studies to determine whether mindfulness-based interventions are effective in MCS, the positive verbal feedback from the MBCT group in this study suggests that the participants who completed the program and practised at home benefitted from the training in terms of improved sleep quality and stress management. The MBCT program was initially developed for preventing depressive relapse and as such the cognitive elements inherent in the programme target the dysfunctional thinking style that is believed to be associated with depressive relapse. Future studies testing the effect of MBCT in MCS would likely benefit from adjusting some parts of the program to fit this group, for example, emphasize stress management.

A recent review by Fjordback *et al.* (2011) showed that completion rates, defined as attending at least four or five sessions, are generally high in mindfulness-based intervention studies. In this study the MBCT group sessions took place in a large room used for mindfulness groups at a psychiatric centre in Copenhagen. The participants in the intervention group were heterogeneous in terms of chronicity and the chemical triggers that were associated with symptoms. In one case the primary problem was symptoms from indoor exposure to moulds and, for example, fragranced products did not elicit symptoms. In another participant a transient exposure to fragranced products caused her to feel ill for days. Some of the participants in the MBCT groups reported feeling ill in the days following a session, which was attributed to chemical exposures during the teaching sessions. Consequently, some of the exercises, such as mindful walking, that is, the use of walking to bring attention to the present, were performed outside in a garden. The windows were kept open throughout the classes if needed. If a participant was unable to attend a session, he or she was e-mailed any written material handed out during the class and was encouraged to contact the mindfulness instructor if needed. In terms of the feasibility of MBCT for MCS, the verbal feedback suggests that the program is beneficial, but some considerations could be given to the environment in which the MBCT sessions take place, for example, being able to do some of the exercises outside if necessary. The issue of heterogeneity with which individuals with MCS respond to a diversity of common chemical exposures, may imply that some individuals respond negatively to each other. To prevent dropout and spending an undue time dealing with these issues during sessions, it is advisable to address the matters beforehand by asking all participants to consider whether they are able to engage in a group setting and to refrain from using fragranced products while attending the classes. Chemically sensitive or intolerant individuals tend to use avoidant coping strategies and pay attention to the external environment in order to identify possible chemical triggers (Gibson *et al*., 2003; Lipson, 2001; Skovbjerg *et al*., 2009). Based on our experience it may be wise to give chemically sensitive participants the possibility to take short breaks during the sessions if needed. Having the choice to take a short break and doing it ''mindfully'' may prevent participants from feeling ill following sessions and thus enhance completion.

The heterogeneity of MCS and the commonly reported symptomatic overlap with several other conditions of unknown aetiology, such as chronic fatigue syndrome, fibromyalgia and irritable bowel syndrome (Aaron & Buchwald, 2001; Fink, Toft, Hansen, Ornbol & Olesen, 2007; Yunus, 2008), are possible sources of bias in clinical studies. In this study MCS was considered present based on questionnaire data, telephone interview or a physician diagnosis. We chose lifestyle adjustments as inclusion criteria since population based studies have shown that reactions to common airborne chemicals are quite common in the general population (Berg *et al*., 2008), suggesting it is a normal physiological response that does not equal illness in most individuals. However, future clinical studies would likely benefit from applying a more uniform approach with stricter case criteria for MCS, perhaps using validated questionnaires such as the Quick Environmental Exposure and Sensitivity Inventory developed by Miller and Prihoda (1999). Our primary effect measure was SCL-92 depression score and secondary and tertiary effect measures included SCL-92 anxiety and somatization scores, and scores on the brief IPQ. While these are relevant measures to include in future studies because of the association with MCS, the lack of an effect measure of MCS in this study can be considered as a limitation and should be kept in mind when interpreting the results. Future studies testing the effect of a mindfulness-based intervention on MCS would benefit from including such a primary effect measure.

CONCLUSIONS

In conclusion no significant differences on effect measures were found, which could be a question of power. The positive verbal feedback from the participants in the MBCT group suggests that a larger randomized clinical trial on the effect of MBCT for MCS could be considered.

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