THE JOURNAL OF ALTERNATIVE AND COMPLEMENTARY MEDICINE
Volume 21, Number 3, 2015, pp. 129–140

DOI: 10.1089/acm.2013.0471

Review Articles

Mindfulness-Based Interventions for the Treatment of Smoking: A Systematic Literature Review

Isabel Cristina Weiss de Souza, MSc,[1] Viviam Vargas de Barros, MSc,[1] Henrique Pinto Gomide, MSc,[2] Tassiana Cristina Mendes Miranda, BA,[2] Vinícius de Paula Menezes, BA,[2] Elisa Harumi Kozasa, PhD,[1,3] and Ana Regina Noto, PhD[1]

Abstract

Objectives: Smoking is a chronic process in which craving and negative affect are considered the main barriers to maintaining abstinence in patients who have gone through treatment. Mindfulness-based interventions have presented encouraging preliminary results in follow-up lasting up to 6 months. The aim of this study was to perform a systematic literature review on the effects of mindfulness-based interventions for the treatment of smoking.

Methods: Of 198 articles on mindfulness and smoking, 13 controlled empirical studies were selected for the analysis. The search included papers published through April 14, 2014. The databases used were Cochrane Central Register of Controlled Trials, PsycINFO, PubMed, and Scopus.

Results: Scientific interest on mindfulness-based interventions for the treatment of smoking has increased over the past decade. All articles reported promising results, especially for smoking cessation, relapse prevention, number of cigarettes smoked, the moderation of mindfulness on the strength of relationship between craving and smoking, and the development of coping strategies to deal with triggers to smoke. Most of the articles corresponded to pilot or feasibility randomized controlled trials with low risk of bias regarding random sequence generation, attrition, and reporting. However, few articles reported sufficient data on selection, performance, and detection bias.

Conclusions: Mindfulness appears to induce positive effects on mental health, which might contribute to the maintenance of tobacco abstinence. Despite the promising results regarding the responses of tobacco smokers to mindfulness-based interventions, additional well-designed clinical studies are needed.

Introduction

The number of smokers worldwide is estimated to be 1,300,000,000; 650 million smokers are expected to lose on average 14 years of life due to smoking-related diseases.[1] Smoking remains the main cause of preventable death and is strongly associated with cardiovascular and lung diseases, several types of cancer, reproductive dysfunction, fetal malformations, diabetes, depression, and an increased risk for other chronic diseases.[2]

Addiction is recognized as a chronic process that entails relapses.[3] Moreover, studies show that both craving and negative affect are conditions that affect the maintenance of abstinence directly, especially regarding tobacco.[4]

A wide range of treatments has been developed to address relapse. Among the behavioral-based interventions is cognitive behavioral therapy, which includes relapse prevention. However, even though this therapy has become a standard of care, the relapse rates remain high; as a result, development of new treatment modalities is needed to improve assistance to individuals during their recovery.[5]

In addition, smokers with some degree of mental discomfort do not feel motivated to stop smoking. As a result, clinicians who have been trained to apply behavioral and pharmacotherapeutic treatments cannot reach this population using existing resources.[6]

Meditation, especially mindfulness training, has been tested in several therapeutic programs, with promising

[1]Department of Psychobiology, Universidade Federal de São Paulo, São Paulo, Brazil.
[2]Department of Psychology, Universidade Federal de Juiz de Fora, Juiz de Fora, Brazil.
[3]Hospital Israelita Albert Einstein, São Paulo, São Paulo, Brazil.

results in the treatment of addiction.[7] Mindfulness-based practices emphasize a modification of the relationship between the client and his or her internal experiences. The strategies to modify such experiences are the central mechanism for therapeutic change, whereas the processes of acceptance and mindfulness are the major mediators of change.[8] Recent studies also showed the important role of trait mindfulness on the reduction of smoking frequency through its impact on negative and anger affect and perceived stress.[9] Therefore, the focus of this approach is based on the acceptance of thoughts, sensations, and feelings while avoiding excessive judgment of these experiences, which are developed through meditation.

The use of mindfulness-based techniques as therapeutic interventions in Western medicine and psychology began in 1979 with the mindfulness-based stress reduction (MBSR) program created by Jon Kabat-Zinn. The MBSR program derived its techniques from the meditation practices and skills of the Buddhist tradition. It was originally formulated for the management of chronic pain and stress-related diseases and consists of eight group sessions lasting 2 hours per week. During the program, methods to practice mindfulness in daily life and meditation techniques are taught (e.g., sitting and walking meditation, body scan, and yoga).[10]

According to Kabat-Zinn, mindfulness is ''moment-to-moment awareness. It is cultivated by purposefully paying attention to things we ordinarily never give a moment's thought to. It is a systematic approach to developing new kinds of control and wisdom in our lives based on our inner capacities for relaxation, paying attention, awareness, and insight.''[10] MBSR emphasizes patience, self-confidence, and psychological acceptance to create a stable basis for internal exploration. Studies have reported promising results of mindfulness-based interventions in the treatment of clinical conditions, such as depression,[11,12] anxiety,[13] chronic pain,[14] and borderline personality disorder.[15]

Preliminary evidence also supports the efficacy of mindfulness-based approaches for the treatment of substance dependence[5,16–18] and other disorders. In such cases, mindfulness reduces stress, craving, abstinence symptoms, and emotional discomfort. However, little is known about the kinds of mindfulness interventions, the patients who might benefit from them, and the research methods used to evaluate their acceptability and efficacy, especially in smoking cessation. With the purpose of filling this gap, the current systematic review was performed to assess the effects of mindfulness or mindfulness-based interventions for the treatment of smoking cessation.

Methods

A systematic review of the literature on the relationship between mindfulness and smoking was performed; the review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[19] The search included papers published through April 14, 2014. To encompass the broadest possible scope of articles, two different search strategies were applied: a search in controlled databases and a search in the references that were cited by the articles in the databases. The Cochrane Central Register of Controlled Trials database, PsycINFO, PubMed, and Scopus were searched by using the following terms: ''mindfulness,'' ''meditation,'' ''smoking cessation,'' ''tobacco smoking,'' ''smoking,'' ''tobacco use disorder,'' ''tobacco use cessation,'' and ''tobacco.'' The search strategy used to search Scopus is described in Supplementary Material 1 (Supplementary Data are available online at www.liebertpub.com/acm). The articles included in the review reported on empirical studies that had intervention and control groups and follow-up measures and that specifically evaluated the role of mindfulness as a mediator of the relation between smoking and other variables, and papers that evaluated the feasibility, efficacy, or effectiveness of mindfulness-based interventions for smoking. The interventions considered for this study ranged from formal isolated practices of meditation belonging to the programs of mindfulness (as the body scan, for example) to complete 8-week programs of mindfulness. With regard to the control group, all the studies that presented some kind of control group were included; these groups ranged from those that used a waiting list to those that used active interventions.

Doctoral and master dissertations, book chapters, correlational studies, and reviews were excluded. In addition, papers written in languages other than English, Portuguese, or Spanish were excluded. The search and screening procedures are depicted in Figure 1. Two independent authors screened the abstracts. After the initial screening, the full text of each article was read and evaluated by pairs of investigators who compared their conclusions and reached a consensus regarding the inclusion of articles. In addition, references in the articles that met the inclusion criteria were analyzed successively until the references were repeated and no new articles could be located. Finally, e-mails were sent to authors to collect studies under review and unpublished studies.

The instrument used in this review to assess the quality of randomized, controlled trials was the Cochrane risk of bias tool, which analyzes the criteria of randomization, allocation concealment, and blinding and assesses whether outcome data are incomplete or reporting is selective, without the assignment of a score, to determine the risk of bias. As suggested by the Cochrane reviews, assigning a score to the risk of bias oversimplifies the analysis and therefore may generate unreliable assessments of validity. The risk of bias is classified as low, high, or unclear.[20]

The articles were read, recorded, and filed for the assessment of the following data: publication year, study design, sample characteristics, location where the study was conducted, instruments used in the study, and results.

Results

Study population, sample, and location

The populations investigated in the studies were distributed as follows: Eight studies investigated smokers among the general population[21–26] (in addition to the published studies, two unpublished studies were included: Davis MJ, ''Comparison between mindfulness training for smokers and integrated training for smokers. Unpublished manuscript'' and Schuman-Olivier et al., ''A randomized controlled trial of mindfulness training for smokers''); two studies targeted smokers among university students;[17,27] one study investigated smokers among hospital employees;[16,19] one study investigated young adult smokers who were alcohol abusers;[28] and one study investigated a sample of smokers with

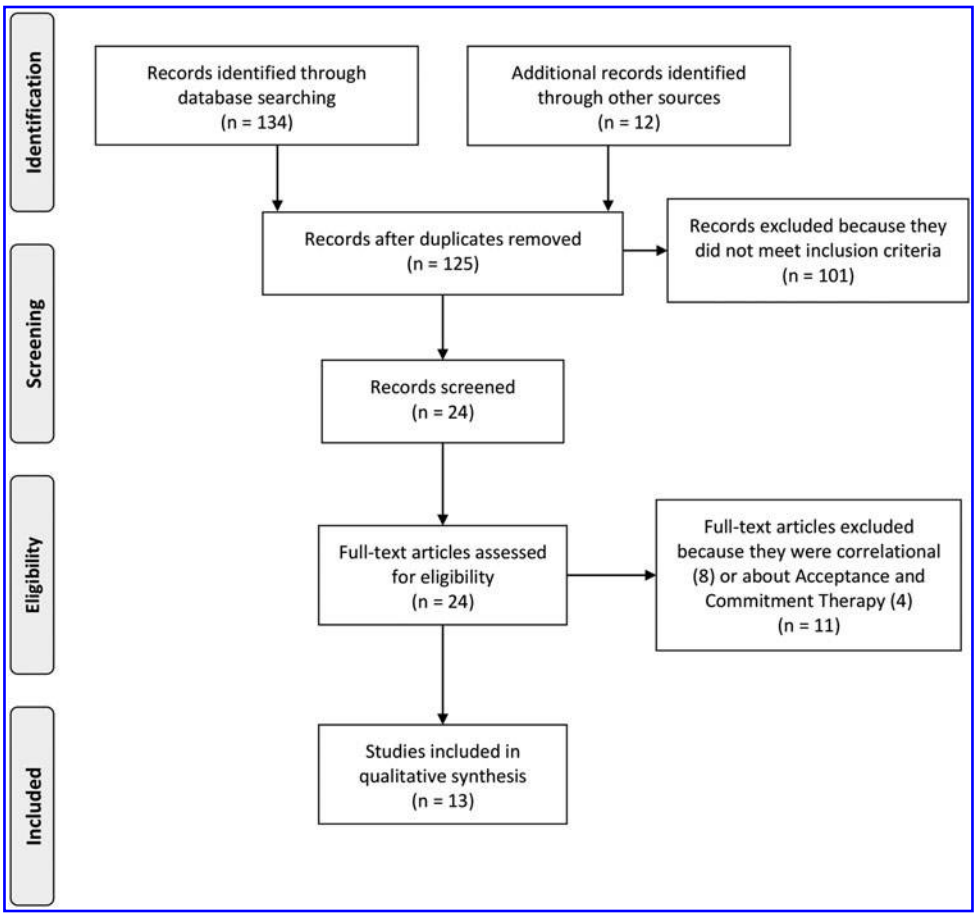

FIG 1. Flowchart of the strategies for searching for and screening of articles.

mild intellectual disabilities.[29] The sample sizes ranged from 48 to 198 participants. All studies were published from 2002 through the cutoff date.

Instruments

We divided instruments into two categories: mindfulness and smoking outcomes (Table 1). Few studies used a structured questionnaire to measure mindfulness, and therefore a consensus about what aspect of mindfulness they were measuring could not be established. The measures were cited only once, and many studies did not report or use any instrument. The studies reported a wide range of measurements for smoking outcomes; most used the Fagestrom Test for Nicotine Dependence, the Timeline Follow-Back, or both. All studies except one[30] used expired carbon monoxide to check for abstinence. Complete data on the frequencies of the instruments are depicted in Table 1.

Clinical studies

The results of the studies on mindfulness-based interventions for tobacco dependence are described in Table 2. Most studies showed that mindfulness programs and techniques had positive effects on quitting rates when compared with controls, despite their methodologic heterogeneity. Two feasibility studies also indicated positive results.[28,30] Training in mindfulness was a useful tool in facing smoking triggers and weakening the relation between craving and the act of smoking, which reduces the number of cigarettes smoked, in studies that briefly instructed the individuals on mindfulness.[27,30]

Studies also showed that individuals who received training in mindfulness, when compared with individuals who received standard treatment (Freedom from Smoking), not only presented a greater decrease in the number of cigarettes smoked but also maintained this reduction in a follow-up after 17 weeks.[21] Another study[22] also presented more encouraging results regarding the cessation rate in a 24-week follow-up of groups that received training in mindfulness plus nicotine replacement therapy when compared with groups that received counseling through quitline plus nicotine replacement therapy. In another study, the cessation rate was also higher in the group that received training in mindfulness when compared with the group that received Integrated Training for Smokers (Davis MJ). In the latter study, however, the difference in relation to the experimental group was not statistically significant in the 24-week follow-up.

Two reports of the same study and same authors with follow-up duration of 7 days did not present better results in the groups that received training in mindfulness.[23,24] The first[24] compared a group that received brief instructions on mindfulness with a group that received guidance in thought suppression. The investigators found a reduction in the number of cigarettes smoked in both groups, without any significant difference between them. The second report[23]

Table 1. Instruments Used to Assess Smoking and Mindfulness Outcomes

Instruments	*Studies with relevant measure (year)*	*f*
Smoking measures		
Smokerlyzer	Altner (2002)[16] Ussher et al. (2006)[26] Brewer et al. (2011)[21] Rogojanski et al. (2011)[23] Rogojanski et al. (2011)[24] Adams et al. (2013)[27] Davis et al. (2013)[28] Davis et al. (2014)[22] Schuman-Olivier et al.[a]	12
Timeline Follow-Back (TLFB)	Brewer et al. (2011)[21] Rogojanski et al. (2011)[23] Rogojanski et al. (2011)[24] Davis et al. (2014)[22]	6
Fagerström Test for Nicotine Dependence (FTND)	Ussher et al. (2009)[25] Bowen and Marlatt (2009)[30] Rogojanski et al. (2011)[23] Rogojanski et al. (2011)[24] Davis[b] Davis et al. (2014)[22]	6
Smoking History Questionnaire (SHQ)	Davis et al. (2013)[28] Davis[b] Davis et al. (2014)[22]	1
Smoking Stages of Change (SOC)	Adams et al. (2013)[27]	1
Questionnaire of Smoking Urges Brief (QSU-brief)	Bowen and Marlatt (2009)[30]	1
Smoking and Quitting History Questionnaire	Bowen and Marlatt (2009)[30]	1
Visual analogue scales (VAS[c])	Adams et al. (2013)[27]	1
Mood and Physical Symptoms Scale (MPSS[d])	Ussher et al. (2009)[25] Rogojanski et al. (2011)[24]	1
Wisconsin Inventory of Smoking Dependence Motives (WISDM-68)	Davis[b] Davis et al. (2014)[22]	1
The Smoking Status Questionnaire (SSQ)-2	Adams et al. (2013)[27]	
Relapse Situation Efficacy Questionnaire (RSER)	Rogojanski et al. (2011)[23] Rogojanski et al. (2011)[24]	
Smoking Monitoring Diary	Bowen and Marlatt (2009)[30]	
Mechanical Tally Counter Button	Singh et al. (2014)[29]	
Mindfulness measures		
Attentional Control Scale	Davis[b] Davis et al. (2014)[22]	1
Five Facet Mindfulness Questionnaire (FFMQ)	Adams et al. (2013)[27] Davis[b] Davis et al. (2014)[22]	1
Timeline Follow-Back, adapted for meditation (TLFB)	Davis et al. (2013)[28]	1
Meditation Calendar	Davis[b] Davis et al. (2014)[22]	1
None or not reported	Altner (2002)[16] Ussher et al. (2006)[26] Ussher et al. (2009)[25] Bowen and Marlatt (2009)[30] Brewer et al. (2011)[21] Rogojanski et al. (2011)[23] Rogojanski et al. (2011)[24] Singh et al. (2014)[29] Schuman-Olivier et al.[a]	6

[a]Schuman-Olivier Z, Pachas G, Hoeppner B, Evins E. A randomized controlled trial of mindfulness training for smokers. Unpublished abstract.
[b]Davis MJ. Comparison between mindfulness training for smokers and integrated training for smokers. Unpublished manuscript.
[c]Participants drew a line between a strong desire to smoke and no desire to smoke, and the length of the drawn line was measured.
[d]Adapted version.
f, frequency.

Table 2. Characteristics and Findings of Included Studies

Study (year)	Participants (n)	Type of participants	Treatment	Follow-up	Main results	Design
Adams et al. (2013)[27]	64	Female undergraduates from a university in the Southeastern United States; smokers; mean age, 20.03 ± 1.77 yr; 87.5% white	2×2 factorial design with body image challenge (trying on a bathing suit vs. looking at a purse) crossed with instructions (mindfulness vs. silence)	NA	There was an interaction between pre–post affect, mindfulness instructions, and body image condition (F[3,55] = 3.68; p = 0.02; η_2 = 0.03. Whereas effect became more positive in the purse + silence group (t[14] = 3.65; p = 0.003], affect became more negative in the body image + silence group (t[14] = 2.79; p < 0.01). Thus, mindfulness reduced the relation between the negative affect concerning body image, acting as a mediator and weakening the relation between craving and the act of smoking.	RCT
Brewer et al. (2011)[21]	88	Adult smokers from general population; mean age, 45.9 ± 10.2 yr; 45.5% from ethnic minority groups; 62.1% men	Mindfulness training vs. standard care (FFS); treatment carried out among the general population (2 weekly 1.5-hr sessions over 4 wk each)	6, 12, and 17 wk	Compared with those randomly assigned to the FFS intervention, individuals who received mindfulness training showed a greater rate of reduction in cigarette use during treatment and maintained these gains during follow up (F[1,87] = 11.11; p < 0.001). They also exhibited a trend toward greater point prevalence abstinence rate at the end of treatment (36% vs. 15%; p = 0.063), which was significant at the 17-wk follow up (31% vs. 6%; p = 0.012).	RCT

(*continued*)

TABLE 2. (CONTINUED)

Study (year)	*Participants* (n)	*Type of participants*	*Treatment*	*Follow-up*	*Main results*	*Design*
Rogojanski et al. (2011)[23]	61	Adult smokers from general community; mean age, 40.3 ± 12.4 yr; 72% white and 41% women	Mindfulness vs. thought-suppression orientations; duration: 20 min	7 d	Regression model yielded a significant interaction between state symptom-focused anxiety and condition membership (t[43]52.97; $p = 0.005$), such that a higher level of state symptom-focused anxiety after the intervention was associated with greater self-efficacy at follow-up in the suppression condition, but reduced levels of self-efficacy within the mindfulness condition.	RCT
Rogojanski et al. (2011)[24]	61	Adult smokers from general community; mean age, 40.3 ± 12.4 yr; 72% white and 41% women	Mindfulness training vs. thought suppression (20-min instructions for each)	7 d	No significant interaction between time and treatment was observed (F[1, 47] = 1.98; $p = 0.17$; partial $\eta_2 = 0.04$), indicating no significant differences between study conditions in the amount of smoking at follow-up	RCT
Ussher et al. (2009)[25]	48	Smokers who smoked ≥ 10 cigarettes per day; mean age, 27.8 ± 8.4 yr; 35.4% women	Body scan vs. isometric exercises vs. reading about natural history (one 10-min session for each)	Experimental study 30 min after intervention	Desire to smoke score was significantly lower for both the isometric exercises and body scan groups vs the control group immediately after the intervention (ANCOVA; F[2,45] = 19.4 and $p < 0.001$; F[2,45] = 8.8 and $p = 0.006$, respectively) and 5 min after intervention (F[2,45] = 14.1 and $p = 0.001$; F[2,45] = 8.9; $p < 0.005$). After 30 min, no significant differences were observed.[a]	RCT

(*continued*)

TABLE 2. (CONTINUED)

Study (year)	*Participants (*n*)*	*Type of participants*	*Treatment*	*Follow-up*	*Main results*	*Design*
Bowen and Marlatt (2009)[30]	123	Psychology students from a large university in the United States who were smokers; mean age, 20.3 ± 3.3 yr; 48% white and 73.2% men	11-min audio instructions of Urge Surfing Technique or any techniques participants were used to.	7 d	Technique was effective in response to triggers; the intervention group smoked fewer cigarettes per day (1.55) than did the control group (0.53) (RMANCOVA; $F[1,97] = 9.81$; $p = 0.002$; Cohen d = 0.64)	RCT
Ussher et al. (2006)[26]	60	Adult smokers; mean age, 32.2 ± 10.4 yr; 75% white and 55% men	Isometric exercises vs. body scan (active control) vs. passive sitting (control); 1 session of 5 minutes for each group	20 min after experiment	ANOVA showed that isometric exercise produced a significantly greater reduction in desire to smoke vs passive control immediately after the intervention and 5 min after the intervention, relative to baseline ($F[1,38] = 7.26$; $p = 0.01$;$\eta^2 = 0.16$). Overall ANOVAs showed significant group by time (6 time points) interactions for isometric exercise vs. body scanning ($F[5, 190] = 4.27$; $p < 0.001$; $\eta^2 = 0.101$) and for body scanning vs. passive control ($F[5, 190] = 3.74$; $p = 0.003$; $\eta^2 = 0.090$) in relation to withdrawal symptoms.	RCT
Altner (2002)[16]	117	Hospital employees who were smokers; mean age, 38.28 yr; 62% female	MBSR (eight 2.5-hr sessions) + NRT or NRT alone (based on Fiore et al. guideline)	15 mo	Fewer individuals in the MBSR group had relapsed at all follow-up assessments. In the MBSR condition, 22.4% relapsed after 15 mo vs. 46.2% in the NRT condition.	2-group, prospective, nonrandomized study

(*continued*)

TABLE 2. (CONTINUED)

Study (year)	*Participants* (n)	*Type of participants*	*Treatment*	*Follow-up*	*Main results*	*Design*
Davis et al. (2014)[22]	198	Low-income adult smokers; mean age, 41.65 ± 13.92 yr; 77.4% white and 50%male	Mindfulness training (one 7-hr class plus 4 weekly sessions of 90 min) + NRT vs. quitline + NRT	24 wk	Among treatment initiators ($n = 118$), abstinence rates significantly differed between the mindfulness training (38.7%) and control (20.6%) groups ($p = 0.05$).	RCT
Davis et al. (2013)[38]	55	Young adult smokers with alcohol abuse; mean age, 21.93 ± 2.3 yr; 90.9% white and 70.9% male	MTS vs. ITS (both six 2-hr sessions)	2 wk	Intention-to-treat analysis showed that smoking abstinence was higher in MTS than in controls at the 2-wk follow-up (MTS, 20%; ILS, 4%; chi-square = 3.14; $p < 0.08$). Analysis of treatment completers revealed that the ITS group increased drinks per week from pre-quit mean of 10.30 ± .42 to post-quit mean of 15.25 ± 8.08 ($p = 0.03$). The MTS group did not increase drinks per week.	RCT
Davis et al.[c]	135	Adult smokers[b]	MTS for vs. ITS (8 classes over 6 wk each)	24 wk	Intention-to-treat analysis showed no difference in abstinence rates at the 4-wk follow-up (MTS, 35.3%; ITS, 34.3 %.). At 24 wk, MTS (26.5%) group showed a larger abstinence rate than the ITS group (20.9%), although the effect did not reach statistical significance.	RCT

(*continued*)

TABLE 2. (CONTINUED)

Study (year)	*Participants* (n)	*Type of participants*	*Treatment*	*Follow-up*	*Main results*	*Design*
Schuman-Olivier et al.[d*]	54	Adult smokers[b]	Mindfulness for smoking vs. FFS[e]	4 mo	Results of generalized estimating equation analysis of intention-to-treat point prevalence during follow-up showed no treatment effect (chi-square = 3.67; $p = 0.056$) and indicated stability over time. At 4-mo follow-up, abstinence rates in the FFS group (8%; $n = 2$) were higher than in the mindfulness for smoking group (17%; $n = 5$).	RCT
Singh et al. (2014)[29]	51	Smokers with mild intellectual disabilities; mean age, 32.56 ± 10.29 yr; 80% male	Mindfulness training (36 wk of daily 20-min mindfulness exercises) vs. treatment as usual	12 mo	At 40-wk, for treatment completers, cessation rates were 100% for mindfulness training group and 38.39% for control group. With intention-to-treat analyses, at 1-yr follow-up, means of cigarettes smoked between experimental (mean, 14.34 ± 34.14) and control group (mean, 40.62 ± 40.27) differed significantly ($t[49] = 2.51$; $p < 0.05$; Cohens d = 0.70).	RCT

Mean values are expressed with standard deviations.
[a]Authors did not report *p*-values of effect sizes estimates.
[b]Mean age, sex, and race were not available.
[c]Davis MJ. Comparison between mindfulness training for smokers and integrated training for smokers. Unpublished manuscript.
[d]Schuman-Olivier Z, Pachas G, Hoeppner B, Evins E. A randomized controlled trial of mindfulness training for smokers. Unpublished abstract.
[e]Number of treatment sessions and time not provided.
RCT, randomized controlled trial; NA, not applicable; FFS, Freedom from Smoking; ANCOVA, analysis of covariance; RMANCOVA, repeated-measures analysis of covariance; ANOVA, analysis of variance; MBSR, mindfulness-based stress reduction; NRT, nicotine replacement therapy; MTS, mindfulness training for smokers; ILS, interactive learning for smokers; ITS, integrated training for smokers.

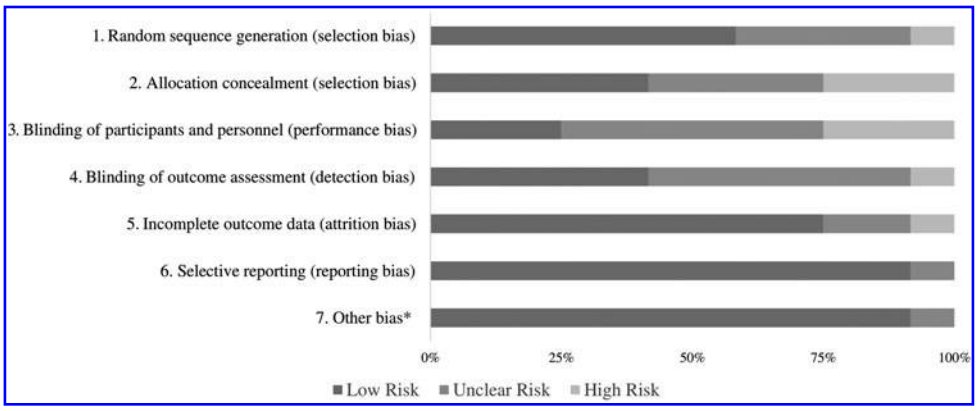

FIG 2. Risk of bias of included studies. *Other sources of bias related to a particular trial design.

showed better results in the facing of anxiety to cue exposure in the group that received guidance in thought suppression when compared with the group that received training in mindfulness. Three studies found ineffective results of mindfulness training and techniques (Schuman Olivier et al.).[25,26] Of these, two were conducted with adult smokers aimed at comparing three conditions in a laboratory setting: isometric exercise, body scan, and passive sitting. There were no differences in either experiments among body scan and isometric exercise groups regarding desire to smoke and withdrawal symptoms, although differences reached statistical significance when isometric exercise groups were compared to the passive sitting group.[25,26] One study (Schuman-Olivier et al.) aimed at comparing Mindfulness Training for Smokers with standard cognitive-behavioral intervention for smoking cessation, Freedom from Smoking for smoking cessation in a population of adult smokers. Abstinence rates in Freedom from Smoking were higher than mindfulness for smoking. Nevertheless, at the last follow-up, no differences were observed between groups. Those three studies shared some limitations, such as underpowered samples and reduced time of intervention.

Article quality: risk of bias

The Cochrane risk of bias tool[20] was used to assess the methodological quality and risk of bias of the papers evaluated (Fig. 2). In general, articles presented low risk of bias regarding random sequence generation (Davis MJ)[21,22,25,28,29] and attrition.[21–24,26–30] All studies presented low risk of reporting bias, except one in which the risk was unclear.[16] For the other types of bias, eight papers presented low risk.[21–23, 26–29] However, few of the articles reported sufficient data on selection,[21, 23–27] performance,[16,23,24,26,29,30] and detection biases,[16,23,24,26,30] which may have occurred because of the nature of mindfulness interventions. This highlights the difficulties for masking group assignment and setting up appropriate control conditions. One paper had high risk of bias regarding selection and attrition bias.[16] One paper also presented high risk of bias concerning performance.[22] Despite having a performance bias, this occurred because the participants could not be blinded as a result of practical implications (the patients had odd working hours, transportation issues, or temporary housing).

In three of the studies that presented a predominantly low risk of bias,[27–29] the group that received mindfulness presented better results in facing craving,[27] a reliable predictor of smoking relapse,[31] abstinence,[22] and cessation rate[29] (the main results expected in smoking cessation treatments[32]).

One study presented high risk of bias for selection and attrition,[16] which could compromise the positive results that were presented in relation to abstinence in the experimental group. The abstract by Schuman-Olivier et al. could not be evaluated with regard to its risk of bias because it is an unpublished study and the full text was not available. Although comparison of the studies analyzed was attempted, few of them presented effect size or even data that would make calculations viable. This makes it difficult to make a more detailed comparison regarding bias risk and the results presented.

Discussion

This is the first systematic review that sought to search the literature for randomized controlled trials of mindfulness-based interventions for tobacco smoking. However, the studies in this review had heterogeneous designs and therefore did not lend themselves to greater comparability. On the other hand, the results point to a promising approach to address in further studies.

The results here improve the understanding of mindfulness and smoking because it focuses only on these two entities, whereas previous reviews included other substances[5] or other mind–body interventions.[33]

One important finding was the heterogeneity of mindfulness measures. Because these measures are new tools and some are still being developed, there is no consensus about which aspect of mindfulness they are measuring. Some of them are multidimensional, such as the FFMQ, and some are only subjective reports of the participants, implying that each study may be measuring different aspects of mindfulness. This in turn directly affects the comparison of results. On the other hand, most studies used biological measures or consolidated self-report measures for smoking, allowing greater comparability for that variable.

Many studies found that the improvement in quality of life with mindfulness training may shorten the duration of treatment and decrease the probability of a relapse, thus strengthening patient motivation to continue treatment and maintain abstinence.[21]

Another important result in most studies was the reduction of negative psychological variables, such as stress, irritability, lack of concentration, depression, anxiety,

negative affect, and psychiatric symptoms, that hinder adherence to abstinence and the appropriate responses to triggers for substance use. However, some of the clinical trials that compared the clinical results of a mindfulness technique with those of a control group (thought suppression technique) did not yield significant differences in relation to the number of cigarettes smoked. Moreover, the individuals who practiced thought suppression did not have greater benefits regarding self-efficacy in coping with anxiety.[23,24] Those reports considered a study that had a 7-day follow-up, which showed the effectiveness of the thought suppression technique in the initial moment of abstinence promotion.

On the other hand, other studies showed that the daily use of thought suppression is associated with elevated desire to smoke.[34] In addition, the lack of a statistically significant difference in those studies between mindfulness and thought suppression may be explained by the short follow-up periods and the brevity of the interventions. Because mindfulness increases with systematic meditation training, it is difficult to assume that it did not work based only on one isolated technique that should be accompanied by an entire mindfulness-based program and should be practiced daily. Previous studies show an inverse relationship between the time practicing meditation and number of cigarettes smoked per day.[21]

Analysis of the publication years showed that studies on mindfulness for smoking cessation were first published 9 years ago. These studies are more recent than the studies on mindfulness for the treatment of other medical conditions. This finding is supported by the number of preliminary and pilot studies found in this review, which aimed at assessing the treatment satisfaction, the potential recruitment of participants, attrition, and the validity of data collected from the participants based on improved clinical experiences due to the intervention. In addition, one of the studies was a randomized clinical trial with good external validity[28] (i.e., the researchers used follow-up periods of 6 months, had powered samples, used a cessation rate by point prevalence as main outcome, and described its results using an intention-to-treat analysis). Despite this, more empirical studies should be conducted on this subject using rigorous methods and powered samples to allow a broader generalization of the results.

The results of this review indicate increasing scientific interest in mindfulness-centered interventions for the treatment of smoking. However, substantial heterogeneity was observed among studies, which compromises the use of meta-analytic statistical approaches to compare them. Studies differed widely regarding the definition of mindfulness training protocols (e.g., extension, intensity, use of medication), and mindfulness measures (e.g., validated or subjective diaries), groups used as controls (e.g., standard care based on Freedom from Smoking; medication; or psychological treatments, such as cognitive behavioral therapy), follow-up periods, and sampling strategies.

Considering the methodologic quality of the studies, blinding the participants and personnel involved in the study to the control and experimental condition is clearly difficult; this limitation was unsatisfactorily discussed. Nevertheless, other strategies must be used to compensate for this lack of adequate blinding, such as the addition of credibility questionnaires about the interventions before and after the experiment, blinding the participants to the research hypothesis, and narrowing the possibilities of participants in different conditions exchanging information. Other strategies include blinding the data analysts and promoting the credibility of both experimental and control interventions to the participants.

Future clinical studies need larger samples, control groups with active interventions, standardized scales to measure the extent of the positive effects, and assessment of the mechanisms of action of mindfulness to allow generalizing of the results. Finally, the inclusion of standardized therapeutic guidelines in study protocols, such as the protocols that are available for MBSR and Mindfulness-Based Relapse Prevention, and use of diaries to measure number of days and time spent on meditation may facilitate the replication of studies and data analysis. The literature on mindfulness has been expanding; future research should adhere to the guidelines of clinical research on tobacco smoking in order to enable evaluation of the effectiveness of mindfulness treatments in meta-analyses and the consequent implementations of those interventions in treatment settings.

Despite the substantial conclusions of this review, it does have some limitations: the exclusion of articles that were not written in English, Portuguese, or Spanish; the exclusion of clinical or feasibility studies without control groups; and the lack of an extensive search for unpublished research. These limitations may have led to the omission of important findings and narrowing the view of the field.

Conclusions

In general, the studies presented promising results regarding the positive effects of mindfulness-based interventions for craving, smoking cessation, and relapse prevention. However, the currently available studies on this subject have many methodologic limitations, such as a limited use of reliable instruments and the association between the results and the levels of mindfulness for an assessment of the responses to the intervention.

Other limitations were also common, such as heterogeneous intervention protocols and different follow-up periods among studies and underpowered sample sizes. For this reason, efficacy and effectiveness studies are needed to best evaluate mindfulness-based interventions for smoking cessation.

The findings suggest that mindfulness may induce positive effects on mental health; however, future studies must include instruments to assess the negative and positive effects and the symptoms of anxiety, depression, and craving because this assessment has not been adequately addressed to date. In addition, data regarding which populations may benefit from mindfulness practices are insufficient.

Acknowledgments

The authors express appreciation for the Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) for financial support.

Author Disclosure Statement

No competing financial interests exist.

References

1. World Health Organization. WHO Report on the Global Tobacco Epidemic: The MPOWER Package. Geneva: World Health Organization, 2008.
2. Siatkowska H, Jastrzebski D, Kozielski J. Smoking and clinical manifestation, lung function impairment, resulting comorbidities. Pol Merkur Lekarski 2010;29:8–13.
3. Leshner AI. Science is revolutionizing our view of addiction—and what to do about it. Am J Psychiatry 1999;156:1–3.
4. Brown RA, Palm KM, Strong DR, et al. Distress tolerance treatment for early-lapse smokers: rationale, program description, and preliminary findings. Behav Modif 2008;32:302–332.
5. Zgierska A, Rabago D, Chawla N, et al. Mindfulness meditation for substance use disorders: a systematic review. Substance Abuse 2009;30:266–294.
6. Otero UB, Perez CdA, Szklo M, et al. Randomized clinical trial: effectiveness of the cognitive-behavioral approach and the use of nicotine replacement transdermal patches for smoking cessation among adults in Rio de Janeiro, Brazil. Cadernos de Saúde Pública 2006;22:439–449.
7. Brewer JA, Elwafi HM, Davis JH. Craving to quit: psychological models and neurobiological mechanisms of mindfulness training as treatment for addictions. Psychol Addict Behav 2013;27:366–379.
8. Roemer L, Orsillo SM. A Prática da Terapia Cognitivo-Comportamental Baseada em Mindfulness e Aceitação. Porto Alegre: Artmed, 2010.
9. Black DS, Milam J, Sussman S, Johnson CA. Testing the indirect effect of trait mindfulness on adolescent cigarette smoking through negative affect and perceived stress mediators. J Substance Use 2012;17:417–429.
10. Kabat-Zinn J. Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain and Illness. New York: Bantam Dell, 1990.
11. Segal ZV, Williams JMG, Teasdale JD. Mindfulness-Based Cognitive Therapy for Depression. New York: Guilford Press, 2001.
12. Teasdale J, Segal Z, Williams J. How does cognitive therapy prevent depressive relapse and why should attentional control (mindfulness) training help? Behav Res Ther 1995;33:25–39.
13. Borkovec T, Alcaine O, Behar E. Avoidance theory of worry and generalized anxiety disorder. In: Heimberg RG, Turk CL, Mennin DS, eds. Generalized Anxiety Disorder: Advances in Research and Practice. New York: Guilford Press, 2004:77–108.
14. Kabat-Zinn J, Massion A, Kristeller J, et al. Effectiveness of a meditation-based stress resduction intervention in the treatment of anxiety disorders. Am J Psychiatry 1992;149: 936–943.
15. Linehan M. Cognitive-Behavioral Treatment of Borderline Personliaty Disorder. New York: Guilford Press, 1993.
16. Altner N. Mindfulness practice and smoking cessation: the EssenHospital Smoking Cessation Study (EASY). J Meditat Meditat Res 2002;1:9–18.
17. Bowen S, Chawla N, Collins S, et al. Mindfulness-based relapse prevention for substance use disorders: a pilot efficacy trial. Substance Abuse 2009;30:295–305.
18. Davis JM, Fleming MF, Bonus KA, Baker TB. A pilot study on mindfulness based stress reduction for smokers. BMC Complement Altern Med 2007;7:2.
19. Moher D, Liberati A, Tetzlaff J, Altman D. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med 2009;6:e1000097.
20. Higgins J, Altman D, Higgins J, et al. Assessing risk of bias in included studies. In: Higgins J, Green S, eds. Cochrane Handbook for Systematic Reviews of Interventions, Version 5.1.0. London: The Cochrane Collaboration, 2011.
21. Brewer JA, Mallik S, Babuscio TA, et al. Mindfulness training for smoking cessation: results from a randomized controlled trial. Drug Alcohol Depend 2011;119:72–80.
22. Davis JM, Goldberg SB, Anderson MC, et al. Randomized trial on mindfulness training for smokers targeted to a disadvantaged population. Substance Use Misuse 2014;49:571–585.
23. Rogojanski J, Vettese LC, Antony MM. Role of sensitivity to anxiety symptoms in responsiveness to mindfulness versus suppression strategies for coping with smoking cravings. J Clin Psychol 2011;67:439–445.
24. Rogojanski J, Vettese LC, Antony MM. Coping with cigarette cravings: comparison of suppression versus mindfulness-based strategies. Mindfulness 2011;2:14–26.
25. Ussher M, Cropley M, Playle S, et al. Effect of isometric exercise and body scanning on cigarette cravings and withdrawal symptoms. Addiction 2009;104:1251–1257.
26. Ussher M, West R, Doshi R, Sampuran AK. Acute effect of isometric exercise on desire to smoke and tobacco withdrawal symptoms. Human Psychopharmacol Clin Exp 2006;21:39–46.
27. Adams CE, Benitez L, Kinsaul J, et al. Effects of brief mindfulness instructions on reactions to body image stimuli among female smokers: an experimental study. Nicotine Tobacco Res 2013;15:376–384.
28. Davis J, Mills D, Stankevitz K, et al. Pilot randomized trial on mindfulness training for smokers in young adult binge drinkers. BMC Complement Altern Med 2013;13:215.
29. Singh NN, Lancioni GE, Myers RE, et al. A randomized controlled trial of a mindfulness-based smoking cessation program for individuals with mild intellectual disability. Int J Mental Health Addiction 2014;12:153–168.
30. Bowen S, Marlatt A. Surfing the urge: brief mindfulness-based intervention for college student smokers. Psychol Addictive Behav 2009;23:666–671.
31. West R, Hajek P, Belcher M. Severity of withdrawal symptoms as a predictor of outcome of an attempt to quit smoking. Psychol Med 1989;19:981–985.
32. Centers for Disease Control and Prevention. Best Practices for Comprehensive Tobacco Control Programs—2014. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014.
33. Carim-Todd L, Mitchell SH, Oken BS. Mind–body practices: an alternative, drug-free treatment for smoking cessation? A systematic review of the literature. Drug Alcohol Depend 2013;132:399–410.
34. Erskine JAK, Ussher M, Cropley M, et al. Effect of thought suppression on desire to smoke and tobacco withdrawal symptoms. Psychopharmacology 2012;219:205–211.

Address correspondence to:
Isabel Cristina Weiss de Souza, MSc
Department of Psychobiology
Universidade Federal de São Paulo
Rua Napoleão de Barros, 925
São Paulo 04024-002
Brazil

E-mail: isabel.weiss8@gmail.com