Mindfulness (2011) 2:129–136
DOI 10.1007/s12671-011-0052-7

ORIGINAL PAPER

Mindfulness Skills and Anxiety-Related Cognitive Processes Among Young Adult Daily Smokers: A Pilot Test

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Published online: 18 April 2011

Abstract We examined specific mindfulness skills (observing, describing, acting with awareness, accepting without judgment, as measured by the Kentucky Inventory of Mindfulness Skills, in terms of anxiety-related cognitive processes among adult daily smokers (n = 90; 43 females; *Mage* = 26.6 years, *SD* = 11.8). Partially consistent with hypotheses, describing and accepting without judgment were each shown to significantly predict perceived control over anxiety-related events. The observed significant effects were evident above and beyond the variance accounted for by gender, smoking rate, and negative affectivity. Although observing also was shown to significantly predict agoraphobic cognition, it was in the opposite direction as was theoretically expected. No evidence of incremental validity for mindfulness skills was evident for anxiety sensitivity. These data highlight the potential explanatory relevance of only specific mindfulness skills in terms of only certain anxiety-based cognitive processes among adult daily smokers.

Keywords Mindfulness · Anxiety · Smoking · Cognitions · Panic-related vulnerability

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Introduction

Although there have been sustained efforts to prevent the onset and maintenance of cigarette smoking, this health behavior remains a significant public health concern and is the leading preventable cause of death and disability worldwide (Centers for Disease Control and Prevention 2008). In recent years, numerous studies have established statistically significant and practically meaningful associations between cigarette smoking and anxiety disorders (Feldner, et al. 2007; Morissette et al. 2007; Patton et al. 1998; Zvolensky et al. 2005b). For example, anxiety vulnerability factors and disorders are related to an increased risk of a variety of smoking problems, including more severe nicotine withdrawal symptoms (Marshall et al. 2009; Zvolensky, et al. 2005a), less success in quitting (Brown et al. 2001; Piper et al. 2010; Zvolensky et al. 2008; Zvolensky et al. 2009), and the tendency to smoke to cope with negative affect states (Novak et al. 2003; Zvolensky et al. 2006). Likewise, smoking behavior uniquely contributes to the onset and maintenance of certain anxiety disorders, such as panic attacks and panic disorder (Breslau and Klein 1999; Isensee et al. 2003; McLeish et al. 2007; Zvolensky and Bernstein 2005). These data highlight clinically important bi-directional relations between smoking and anxiety and its disorders.

Efforts to develop targeted interventions for smokers with anxiety concerns or disorders have been highly limited (Ziedonis et al. 2008). One important question driving this type of intervention development pertains to the identification of malleable factors that may relate to greater anxiety-related cognition among smokers. Indeed, integrative models of smoking-anxiety co-occurrence and empirical evidence suggest that anxiety-based cognition (e.g., "I am going crazy") may contribute to the tendency to be emotion-

ally reactive to smoking-based cues (e.g., bodily sensations), and smoke predominately for emotion regulatory reasons (Gonzalez et al. 2009; Zvolensky and Bernstein 2005; Zvolensky et al. 2003). Thus, to the extent that such malleable variables can be isolated, they could then theoretically be targeted in specialized intervention programs for smokers with co-occurring anxiety vulnerabilities or psychopathology.

It is noteworthy that there has been an increased level of scholarly and clinical attention focused on acceptance and mindfulness-based behavioral interventions in the study and treatment of psychopathology, including smoking (Bishop et al. 2004; Orsillo and Roemer 2005; Vidrine et al. 2009). One promising and increasingly utilized conceptualization of mindfulness has been offered by (Baer et al. 2004, p. 193), reflecting the "general tendency to be mindful in daily life" across a number of different domains; this conceptualization is distinct from other mindfulness constructs (e.g., Adele, and Feldman 2004; Brown and Ryan 2003; Conte et al. 1996). As measured by the self-report Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al. 2004), mindfulness skills are conceptualized as both potential risk (lower levels of mindfulness) and protective (high levels of mindfulness) factors. The KIMS has been found to index four internally consistent factors (Baer et al. 2004): (1) the ability to observe cognitions, emotions, and sensations, and external phenomena such as sounds and smells (observing factor); (2) the ability to apply words to observed phenomena (describing factor); (3) the ability to limit attention to the current activity or present moment (acting with awareness factor); and (4) the ability to experience the present state without evaluating or judging its content (accepting without judgment factor). Initial work supports the convergent and discriminant validity of the KIMS with a variety of symptom measures of negative affect as well as emotional dysregulation (Dekeyser et al. 2008; McKee et al. 2007; Vujanovic et al. 2010; Vujanovic et al. 2009).

Based on the conceptualization of Baer et al. (2004), mindfulness skills should be associated with anxiety-related cognitive processes among smokers because present moment awareness, the theorized pre-potent active element of mindfulness skills, is antithetical to the future-oriented thought processes involved in anxiety-oriented cognition and corresponding emotion regulation tactics. For example, because attention has a limited capacity (Schneider and Shiffrin 1977), intentionally observing and describing thoughts as they occur may theoretically prevent or reduce the impact of additional anxiety-related cognition on emotion regulatory behavior such as smoking (Baer et al. 2004). As a second example, the skill of describing could theoretically influence anxiety-based cognition by affording a greater sense of understanding of experiences (emotional processing), thereby increasing a sense of perceived control over anxiety-related events (Baer et al. 2004). Acting with awareness also would be theoretically expected to relate to anxiety cognition, as fully engaging in one activity requires that attention remains focused on the event, rather than preoccupied with other thoughts (Baer et al. 2004).

Together, the aim of the current pilot study was to evaluate whether mindfulness skills, based on the Baer et al. (2004) model, might serve a theoretically protective function in terms of anxiety-based cognition among daily smokers. If mindfulness processes are to offer unique explanatory value in terms of anxiety-based cognition among smokers, such prcesses should account for variance not better explained by daily smoking rate, negative emotionality, and gender. It was hypothesized that after controlling for the variance accounted for by gender, smoking rate, and negative affectivity that: (1) the describing, acting with awareness, and accepting without judgment subscales of the KIMS would be significantly associated with perceived control over anxiety-related events, given that labeling events implies an undersatnding of their occurrence, and perceived control should be greater for events that one can understand (Baer et al. 2004); (2) the accepting without judgment and acting with awareness subscales of the KIMS would be significantly associated with anxiety sensitivity, as it would be theoretically difficult to focus on bodily processes with nonjudgment and acceptance when one fears internal sensations (Baer et al. 2004); and (3) the observing, accepting without judgment, and acting with awareness subscales of the KIMS would be significantly associated with agoraphobic cognition, since openly noticing and focusing on present moment events should limit the opportunity for intrusive, worrisome thoughts (Baer et al. 2004).

Method

Participants

Participants were 90 daily cigarette smokers (48% female, mean age=26.6 years, SD=11.8) recruited from the greater Burlington, VT, USA community. The racial distribution of the sample generally reflected that of the Vermont population (State of Vermont Department of Health 2007): 93.3% Caucasian, 5.6% African American, and 1.1% other. Approximately 73% of the sample had at least some college education, 10% had graduated high school, 8% had less than a high school degree, 4.5% had a 4-year college degree, and 4.5% had a graduate degree. Participants smoked, on average, 18 cigarettes per day (SD=7.7) and had been regular daily smokers for 11.3 years (SD=12.5). The average level of nicotine dependence, as indexed by the Fagerström Test

for Nicotine Dependence (Heatherton et al. 1991), was 3.5 (SD=2).

Participants were administered a modified version of the Structured Clinical Interview for DSM-IV Axis I Disorders—Non-Patient Edition by trained raters (First et al. 1995). This version assessed for major depressive disorder and all of the anxiety disorders except for specific phobia. As this was part of a larger study on the etiology of panic disorder, individuals with a diagnosis of panic disorder were excluded. The participants reported the following history of (current or past) mood and anxiety disorders: 25.6% had major depressive disorder, 10% had post-traumatic stress disorder, 4.4% had generalized anxiety disorder, 4.4% had social phobia, and 2.2% had obsessive–compulsive disorder. Overall, 31% of the sample endorsed at least one of these disorders. Reliability ratings by an independent rater (MJZ) were completed on a random selection of 20% of the protocols, with no cases of disagreement being observed.

Measures

Structured Clinical Interview for DSM-IV-TR Axis I Disorders—Non-patient Edition The Structured Clinical Interview for DSM-IV-TR Axis I Disorders—Non-patient Edition (SCID-NP) is a well-established diagnostic interview for psychiatric problems (First et al. 1995). The interview was administered in order to determine participants' history of psychiatric problems.

Smoking History Questionnaire Smoking history and pattern was assessed with the Smoking History Questionnaire (SHQ; Brown et al. 2002), a measure that includes items pertaining to smoking rate, age of onset of initiation, and years of being a daily smoker.

Fagerström Test for Nicotine Dependence The Fagerström Test for Nicotine Dependence (FTND) is a six-item scale designed to assess gradations in tobacco dependence (Heatherton et al. 1991). The FTND is a revision of the Fagerström Tolerance Questionnaire (FTQ; Fagerström 1978) The FTND has shown good internal consistency, positive relations with key smoker variables (e.g., saliva cotinine; Heatherton et al. 1991, Payne, Smith, McCracken, McSherry, and Antony 1995) and high degrees of test–retest reliability (Pomerleau et al.1994).

Positive Affect Negative Affect Schedule The Positive Affect Negative Affect Schedule (PANAS; Watson et al. 1988) is a mood measure commonly used in psychopathology research (Watson 2000). In the present study, we used only the negative affectivity scale (PANAS-NA) as an index of the broad-based disposition to experience negative affective states (e.g., anger, anxiety, depression, guilt). Internal consistency in the current sample was good for the negative affectivity scale (α=0.92).

Kentucky Inventory of Mindfulness Skills The KIMS is a 39-item self-report measure on which respondents indicate, on a five-point Likert-type scale (1=never or very rarely true to 5=almost always or always true), the general tendency to be mindful in everyday life (Baer et al. 2004). It was designed for use among individuals without any experience in practices related to mindfulness skills (e.g., meditation), and thus, is appropriate for use in general community samples. Factor analysis indicates that the KIMS assesses four factors: (1) observing (e.g. "I notice when my moods begin to change"); (2) describing (e.g., "I can easily put my beliefs, opinions, and expectations into words"); (3) acting with awareness (e.g., "when I'm doing something, I'm only focused on what I'm doing, nothing else"); and (4) accepting without judgment (e.g., "I criticize myself for having irrational or inappropriate emotions"—reverse scored). The KIMS shows adequate to good test–retest reliability (r=0.65–0.86) and good internal consistency (α= 0.91–0.83). The subscales are only modestly correlated with one another (r=0.09–0.34), indicating that they assess related, yet distinct, aspects of mindfulness (Baum et al. 2010). (Baer et al. 2006) recently developed the Five Factor Mindfulness Questionnaire (FFMQ). The FFMQ consists of the four mindfulness factors indexed by the KIMS in addition to a fifth factor entitled Nonreactivity to Inner Experience. Yet, Baer et al. (2006) caution that the FFMQ requires extensive scientific exploration, and they continue to promote the utility of the KIMS in measuring four of the five identified mindfulness facets at the present stage of research. Thus, we opted to employ the KIMS at the present stage of research development. In the current sample, Cronbach's alpha was 0.85 for the Observing subscale, 0.88 for the describing subscale, 0.76 for the acting with awareness subscale, and 0.92 for the accepting without judgment subscale.

Anxiety Control Questionnaire The Anxiety Control Questionnaire (Rapee et al. 1996) is a self-report measure of perceived control over anxiety states and anxiety-related events. Participants are asked to rate the degree to which they agree with statements tapping control-oriented beliefs over anxiety-related internal and external events (e.g., "I can usually relax when I want.") on a six-point Likert-type scale (0=strongly disagree to 5=strongly agree). Higher scores reflect a greater degree of perceived control. Factor analysis indicates a three factor lower-order solution (emotional control, threat control, stress control) that load on a higher-order factor (global perceived control over anxiety-related events; Brown et al. 2004). Consistent with past works (Gregor and Zvolensky 2008; Gregor et al. 2008), we used

the revised 15-item global Anxiety Control Questionnaire score to index a general perception of control over anxiety-related events. In the present study, Cronbach's alpha for the Anxiety Control Questionnaire was 0.86. Hereafter, the Anxiety Control Questionnaire will be referred to as the PACQ (perceived anxiety control questionnaire) to avoid confusion with the Agoraphobic Cognitions Questionnaire.

Anxiety Sensitivity Index The Anxiety Sensitivity Index (ASI; Reiss et al. 1986) is a well-validated measure that assesses the degree to which participants fear negative consequences stemming from anxiety symptoms. Previous research indicates that the ASI is made up of one higher-order factor and three lower-order factors: physical, psychological, and social concerns (e.g., Rodriguez et al. 2004). In the present investigation, we utilized the total ASI score, as it represents the global-order AS factor and therefore takes into consideration different types of fears, including fears of panic-related somatic, cognitive, and social cues. In the present study, the alpha for the ASI was 0.95.

Agoraphobic Cognitions Questionnaire The Agoraphobic Cognitions Questionnaire is a 14-item measure that assesses how frequently an individual experiences frightening or maladaptive thoughts about the consequences of panic and anxiety (Chambless et al. 1984). Respondents are asked to rate items on a 5-point Likert-type scale (1=thought never occurs to 5=thought always occurs) how often fearful cognitions related to the negative consequences of anxiety occur while feeling anxious. The Agoraphobic Cognitions Questionnaire has been shown to have excellent psychometric properties (Chambless et al. 1984). Cronbach's alpha for the Agoraphobic Cognitions Questionnaire in the present investigation was 0.85

Procedure

Participants responding to community-based advertisements for a research study focused on emotion were scheduled for an individual appointment by a trained research assistant. After providing informed, written consent, participants were administered the structured clinical interview by a trained research assistant or doctoral level graduate student and were then asked to complete a self-report battery to assess smoking and affect-related variables. Upon completion of the study, participants were debriefed regarding the aims of the study and compensated $20 for their efforts.

Analytic Approach

The incremental predictive validity of individual mindfulness skills were evaluated in terms of each dependent variable using hierarchical multiple regression. Separate models were constructed to predict perceived control over anxiety-related events, anxiety sensitivity, and agoraphobic cognitions. At step one, gender, smoking rate, and negative affectivity were entered simultaneously as covariates in order to control for these theoretically relevant factors. At the second step, observing, describing, acting with awareness, and accepting without judgment were simultaneously entered into the model to estimate the amount of variance accounted for by each individual mindfulness skill.

Results

Please see Table 1 for associations among predictor and criterion variables. The mindfulness skills of describing, acting with awareness, and accepting without judgment were all significantly associated with one another (range, 0.22 to 0.40). Observing was significantly associated with describing (r=0.36); however, it was not significantly associated with acting with awareness and was negatively associated with accepting without judgment (r=−0.30). Describing, acting with awareness, and accepting without judgment were significantly associated with perceived control over anxiety-related events (range, 0.22 to 0.46). Acting with awareness and accepting without judgment were significantly positively correlated with agoraphobic cognition (r=−0.37 and −0.46, respectively), while observing was significantly positively associated with agoraphobic cognition (r=0.39). Describing, acting with awareness, and accepting without judgment were significantly negatively correlated with anxiety sensitivity (range, −0.24 to −0.46), while observing was significantly positively correlated with anxiety sensitivity (r=0.23). Acting with awareness and accepting without judgment were significantly negatively correlated with negative affectivity (r=−0.25 and −0.43, respectively).

Results of the hierarchical regressions are presented in Table 2. For perceived control over anxiety-related events, step one of the model accounted for 36.1% of the variance, and negative affectivity was the only significant predictor (β=−0.58, p<0.01). Step two accounted for 15% of unique variance. Describing (β=0.29, p<0.01) and accepting without judgment (β=0.24, p<0.05), but not observing or acting with awareness, were significant predictors at step two.

In terms of anxiety sensitivity, step one of the model accounted for 50.1% of unique variance. Negative affectivity was the only significant predictor (β=0.71, p<0.01). Step two of the model accounted for 5.7% of unique variance. In contrast to expectation, none of the mindfulness skills were significant univariate predictors of anxiety sensitivity.

Table 1 Descriptive data and intercorrelations among predictor and criterion variables

	1	2	3	4	5	6	7	8	9	10	Range	Mean	SD
1. Gender	–	−0.26*	0.08	0.04	−0.13	−0.27**	−0.26*	−0.10	0.25*	0.15	–	–	–
2. CPD	–	–	0.11	−0.10	0.07	0.12	0.19	−0.10	−0.01	−0.07	3–50	17.92	8.26
3. PANAS-NA	–	–	–	0.19	−0.16	−0.25*	−0.43**	−0.59**	0.71**	0.71**	10–48	21.34	8.85
4. KIMS-Observe	–	–	–	–	0.36**	−0.05	−0.30**	0.05	0.39**	0.23*	13–57	35.66	8.90
5. KIMS-Describe	–	–	–	–	–	0.22*	0.27*	0.45**	−0.16	−0.24*	12–40	27.31	6.65
6. KIMS-Act	–	–	–	–	–	–	0.40**	0.22*	−0.37**	−0.35**	10–38	28.02	6.02
7. KIMS-Accept	–	–	–	–	–	–	–	0.46**	−0.46**	−0.46**	9–45	31.31	8.64
8. PACQ	–	–	–	–	–	–	–	–	−0.54**	−0.57**	14–70	45.90	12.71
9. ACQ	–	–	–	–	–	–	–	–	–	0.71**	1–3.14	1.57	.53
10. ASI	–	–	–	–	–	–	–	–	–	–	0–64	23.95	15.70

Gender: 1=male, 2=female

CPD cigarettes per day, *PANAS-NA* Positive Affect Negative Affect Schedule—Negative Affect subscale (Watson et al. 1988), *KIMS-Observe* Kentucky Inventory of Mindfulness Skills-Observing subscale (Baer et al. 2004), *KIMS-Describe* Kentucky Inventory of Mindfulness Skills- Describing subscale (Baer et al. 2004), *KIMS-Act* Kentucky Inventory of Mindfulness Skills-Acting with Awareness subscale (Baer et al. 2004), *KIMS-Accept* Kentucky Inventory of Mindfulness Skills- Accepting without Judgment subscale (Baer et al. 2004), *PACQ* [Perceived] Anxiety Control Questionnaire (Rapee et al. 1996), *ACQ* Agoraphobic Cognitions Questionnaire (Chambless et al. 1984), *ASI* Anxiety Sensitivity Index (Reiss et al. 1986).

*correlation is significant at 0.05 level, **correlation is significant at 0.01 level

For agoraphobic cognition, the first step accounted for 52.9% of the variance. Negative affectivity (β=0.68, p<0.01) and gender (β=0.20, p<0.05) were the only significant predictors; females reported higher agoraphobic cognition than males. Step two of the model accounted for 9.7% of unique variance. Observing (β=0.31, p<0.01) was the only significant predictor, although acting with awareness approached statistical significance (β=−0.15, p=0.06).

Discussion

The purpose of the present study was to provide an initital examination of the incremental explanatory value of the mindfulness skills of observing, describing, acting with awareness, and accepting without judgment in terms of anxiety-related cognitive processes among daily smokers. Partially consistent with hypotheses, describing and accepting without judgment significantly predicted perceived control over anxiety-related events. These effects, accounting for 15% of unique variance, were apparent even after controlling for the variance accounted for by gender, smoking rate, and negative affectivity. Such results suggest that there are differential patterns of associations between specific mindfulness skills and anxiety-based control beliefs among daily adult smokers. Specifically, the ability to apply words to phenomena and the ability to experience the present state without evaluation or judgment seem to be primarily related to perceived control over anxiety-related events. These findings are consistent with the (Baer et al. 2004) model of mindfulness skills as applied to smoking and anxiety processes.

Interestingly, the observing subscale of the KIMS significantly predicted agoraphobic cognition above and beyond the variance accounted for by the covariates. However, in contrast to expectation, this association was in the opposite direction of what was hypothesized. Indeed, greater levels of observing predicted increased agoraphobic cognitions. Moreover, observing was significantly negatively correlated with accepting without judgment. These results suggest that utilizing the observing skill in the absence of other mindfulness skills may be possibly disadvantagous. Interestingly, initial validation of the KIMS indicated that the observing subscale might be influenced by meditation experience (Baer et al. 2004). Furthermore, using the FFMQ, a measure related to the KIMS (Baer et al. 2008), found that observing was significantly associated with psychological well-being among experienced meditators, but not among non-meditators. Thus, it is possible that the KIMS observing subscale may not adequately assess the observing skill among the general, non-meditating population.

Also in contrast to prediction, there was no empirical evidence that any of the mindfulness skills, as measured by

Table 2 Mindfulness skills of observing, describing, acting with awareness, and accepting without judgment predicting anxiety-related cognitive risk factors

	ΔR^2	*t* (each person)	β	sr^2	*p*
Criterion variable: perceived control over anxiety-related events					
Step 1	0.36				<0.01
Gender		−0.72	−0.07	0.00	ns
Cigarettes per day		−0.45	−0.04	0.00	ns
Negative affectivity		−6.33	−0.58	0.32	<0.01
Step 2	0.15				<0.01
Observing		0.49	0.05	0.00	ns
Describing		3.07	0.29	0.06	<0.01
Acting with awareness		−0.51	−0.05	0.00	ns
Accepting without judgment		2.31	0.24	0.03	<0.05
Criterion variable: anxiety sensitivity					
Step 1	0.50				<0.01
Gender		0.58	0.05	0.00	ns
Cigarettes per day		−1.69	−0.14	0.02	ns
Negative affectivity		8.70	0.71	0.47	<0.01
Step 2	0.06				0.05
Observing		1.63	0.15	0.01	ns
Describing		−1.61	−0.15	0.01	ns
Acting with awareness		−1.66	−0.14	0.02	ns
Accepting without judgment		−0.44	−0.04	0.00	ns
Criterion Variable: Agoraphobic Cognition					
Step 1	0.53				<0.01
Gender		2.43	0.20	0.03	<0.05
Cigarettes per day		−0.38	−0.03	0.00	ns
Negative affectivity		8.58	0.68	0.43	<0.01
Step 2	0.10				<0.01
Observing		3.73	0.31	0.07	<0.01
Describing		−1.51	−0.13	0.01	ns
Acting with awareness		−1.92	−0.15	0.02	0.06
Accepting without judgment		0.34	−0.03	0.00	ns

β standardized beta weight, sr^2 squared semi-partial correlation.

the KIMS, were incrementally predictive of anxiety sensitivity. Thus, mindfulness skills do not appear to offer unique explanatory value for fears about the negative consequences of anxiety symptoms. This finding, in conjunction with the aforementioned results for perceived control over anxiety-related events and agoraphobic cognition, underscore the importance of explanatory specificity in regard to mindfulness skills and anxiety-based cognition among smokers.

The results of the present study were not fully consistent with a priori prediction. Yet, this type of investigation is helpful in terms of better understanding the nature of mindfulness processes, as basic research has been largely absent despite clinical interest in these variables. Overall, the present findings suggest that it may be fruitful to continue to empirically evaluate the potential of mindfulness skills focused on smokers with, or at risk for, anxiety psychopathology. The ability to describe and accept events (including cognitions) without fearing them or trying to control them appears to have particular relevance for perceived control over anxiety-related events. For example, as high levels of perceived control for anxiety-related events are negatively associated with anxiety symptoms (Forsyth et al. 2003) and related to coping-oriented smoking (Gregor et al. 2008), teaching smokers with anxiety-related problems or vulnerabilities to label and accept aversive experiences (e.g., withdrawal symptoms) may reduce the impact of their anxiety symptoms, and perhaps, ultimately aid smoking-cessation efforts. Future research is needed to determine whether these findings are equally evident for other anxiety-related constructs, such as behavioral avoidance.

There are a number of interpretative caveats of the present study. First, the current findings were based on a community sample of relatively adult daily smokers. In the future, it may be useful to explore whether similar associations are evident for smokers seeking treatment for smoking cessation as well as among ethnically diverse individuals. Second, due to the cross-sectional and correla-

tional nature of the present research design, it is not possible to make causal statements concerning the relations between the studied variables. For example, although we oriented the study on mindfulness processes impacting anxiety-based cognition, the opposite relation is possible. One important next step in this line of inquiry would be to use prospective research methodologies and evaluate the consistency of the present findings over time. Third, the KIMS was employed in the present investigation. However, this instrument represents only one type of measurement device and operates from one type of mindfulness conceptual model (Baer et al. 2004). Future work could therefore benefit by exploring whether similar or distinct patterns are evident for alternative mindfulness conceptualizations. Finally, self-report methods were utilized to index the variables of interest. Thus, there is the possibility of shared method variance contributing to the study results. Finally, the sample consisted of regular but not "heavy" smokers (i.e., low levels of nicotine dependence; Pomerleau et al. 1989). Thus, the results may be, in part, related to a self-selection bias related to this segment of the smoking population. Future work would benefit from replicating this work among a more diverse group of heavier smokers.

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