Original Investigation

Effects of Brief Mindfulness Instructions on Reactions to Body Image Stimuli Among Female Smokers: An Experimental Study

Claire E. Adams, Ph.D.,^{1,2} Lindsay Benitez, B.S.,^{2,3} Jessica Kinsaul, M.A.,² Megan Apperson McVay, M.A.,^{2,4} Allyson Barbry, B.S.,² Alexa Thibodeaux, B.S.,² & Amy L. Copeland, Ph.D.²

¹ Department of Health Disparities Research, The University of Texas MD Anderson Cancer Center, Houston, TX

² Department of Psychology, Louisiana State University, Baton Rouge, LA

³ Department of Psychology, The University of Tennessee at Chattanooga, Chattanooga, TN

⁴ Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC

Corresponding Author: Claire E. Adams, Ph.D., Postdoctoral Fellow, Department of Health Disparities Research–Unit 1440, The University of Texas MD Anderson Cancer Center, PO Box 301402, Houston, TX 77230-1402, USA. Telephone: 713-563-7546; Fax: 713-792-7196; E-mail: cadams@mdanderson.org

Received November 15, 2011; accepted April 17, 2012

Note. This research was conducted as part of the first author's doctoral dissertation under the direction of Amy L. Copeland, Ph.D., at Louisiana State University.

Abstract

Introduction: Recent research has shown that body image stimuli increase negative affect and smoking urges among female smokers. Mindfulness (paying attention to present-moment experience with an attitude of nonjudgmental acceptance) may be a useful technique to minimize the influence of body dissatisfaction on negative affect, smoking urges, and smoking behavior.

Methods: This study investigated whether mindfulness influences how female college smokers respond to a body image challenge. The study used a 2×2 factorial design with body image challenge (trying on a bathing suit vs. looking at a purse) crossed with instructions (mindfulness vs. silence). Female smokers ($n = 64$; $M_{\text{age}} = 20.03 [\pm 1.77]$, 87.5% Caucasian) were randomly assigned to one of four conditions: Purse + Silence ($n = 16$), Body Image + Silence ($n = 15$), Purse + Mindfulness ($n = 15$), and Body Image + Mindfulness ($n = 18$).

Results: Compared with participants in silence conditions, participants who received mindfulness instructions reported increases in state mindfulness. Whereas participants who tried on the bathing suit in silence reported increases in negative affect and body dissatisfaction, those who tried on the bathing suit with mindfulness instructions did not. Furthermore, mindfulness attenuated relationships between negative affect and smoking urges. Whereas negative affect predicted higher smoking urges among participants in silence conditions, negative affect was unrelated to smoking urges among participants receiving mindfulness instructions. Mindfulness also appeared to weaken

the association between urges and likelihood of smoking after the body image challenge.

Conclusions: Results provide preliminary support for the use of mindfulness-based treatments for female smokers in coping with body dissatisfaction.

Introduction

Cigarette smoking is the leading cause of preventable mortality in the United States, and smoking has additional consequences for women, including increased risk for cervical cancer, reproductive complications, and hormone irregularities (Centers for Disease Control and Prevention, 2002). Female smokers often report heightened levels of body dissatisfaction (Kendzor, Adams, Stewart, Baillie, & Copeland, 2009; King, Matarin, Marcus, Bock, & Tripolone, 2000), which can prompt smoking initiation and interfere with quit attempts (King, Matarin, White, & Marcus, 2005; Stice & Shaw, 2003). Lopez, Drobes, Thompson, & Brandon (2008) investigated the effect of a manipulation designed to prime body dissatisfaction on smoking urges among female smokers. Participants viewed either thin models (body image challenge) or neutral cues in the presence or absence of smoking cues. Consistent with past research (Groesz, Levine, & Murnen, 2002), viewing thin models increased body dissatisfaction compared with neutral images. Furthermore, pictures of thin models and smoking cues each independently increased urges to smoke, indicating that priming body dissatisfaction increased smoking urges even in absence of smoking cues.

doi:10.1093/ntr/nts133

Advance Access publication September 17, 2012

© The Author 2012. Published by Oxford University Press on behalf of the Society for Research on Nicotine and Tobacco. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com

Lopez Khoury, Litvin, and Brandon (2009) investigated the effects of another body image manipulation (trying on a bathing suit) among female smokers. Participants either tried on a bathing suit in front of a mirror or looked at a purse, in the presence or absence of smoking cues. Compared with the purse condition, the body image manipulation increased body dissatisfaction and triggered urges to smoke for negative affect reduction. Negative affect mediated the relationship between body image challenge and smoking urges, suggesting that priming body dissatisfaction increases negative affect, which in turn increases smoking urges. Smoking may represent an attempt to relieve distress associated with body dissatisfaction.

Additional research suggests that priming body dissatisfaction induces negative affect (Pinhas, Toner, Ali, Garfinkel, & Stuckless, 1999), and negative affect is a common trigger for smoking urges (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Brandon, 1994; Brandon, Wetter, & Baker, 1996; Payne, Schare, Levis, & Colletti, 1991). Negative affect has also been linked to difficulties in smoking cessation and relapse (Brandon, 1994). Because body dissatisfaction and associated negative affect can trigger smoking urges, it is crucial to develop treatments to target body dissatisfaction and weight concerns in smokers. Accordingly, Perkins et al. (2001) developed a cognitive-behavioral treatment (CBT) targeting smokers' weight concerns. Compared with behavioral weight loss treatment and standard treatment, CBT (in conjunction with standard smoking cessation treatment) was more effective in improving smoking abstinence over the next year.

Although CBT has merit for reducing weight concerns, mindfulness-based strategies might be more acceptable to women with body image concerns, for whom viewing their bodies with emotional neutrality may seem more reasonable than challenging dysfunctional thoughts (Stewart, 2004). Mindfulness (paying attention to present-moment experience with an attitude of acceptance; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Kabat-Zinn, 1994) is one alternative method for coping with negative thoughts and emotions related to body image. Wilson (1999, 2004) developed mindfulness-based mirror exposure (ME), which encourages clients to observe and describe their bodies nonjudgmentally. Rather than trying to avoid unpleasant thoughts or feelings, patients are taught to accept their experience and tolerate any unpleasant sensations that arise (Delinsky & Wilson, 2006). Mindfulness-based ME has received preliminary empirical support for reducing body image dysfunction (Delinsky & Wilson, 2006).

Researchers have studied mindfulness as a naturally occurring individual difference (*trait mindfulness*), as a state that varies within individuals (*state mindfulness*) and as a longer term intervention (*mindfulness-based treatment*). Trait (or dispositional) mindfulness refers to an individual's tendency to observe and accept present-moment experiences in day-to-day life (Baer et al., 2006; Brown & Ryan, 2003). Among smokers, those with higher trait mindfulness tend to report lower negative affect, lower nicotine dependence, and less-severe withdrawal symptoms (Vidrine et al., 2009; Waters et al., 2009). Whereas trait mindfulness questionnaires assess individuals' general tendencies to be mindful (e.g., Brown & Ryan, 2003), state mindfulness questionnaires ask participants about their experiences during a specific time (e.g., "just now," Lau et al., 2006). Brief mindfulness training might increase individuals' levels of state mindfulness and associated behavior. For example, Westbrook, Creswell, Tabibnia, Julson, Kober, & Tindle (2011)

provided smokers with brief mindfulness instructions (intended to increase state mindfulness), which reduced cue-elicited cigarette craving. Preliminary research also supports the use of longer mindfulness-based treatments in aiding smoking cessation (Brewer et al., 2011; Davis, Fleming, Bonus, & Baker, 2007).

Although trait mindfulness, brief mindfulness-based instructions, and multisession mindfulness-based treatments appear related to improved smoking outcomes, more research is needed on the mechanisms of mindfulness. One possibility is that in addition to reducing negative affect, mindfulness weakens the relationships between negative affect, smoking urges, and smoking behavior. In support of this hypothesis, Bowen and Marlatt (2009) found that the association between negative affect and smoking urges was weaker among smokers given mindfulness-based instructions to cope with smoking urges than among those in a control condition. Participants in the mindfulness group also smoked fewer cigarettes over the next week. Mindfulness instructions did not lower urges or negative affect but changed the relationship between urges and affect, suggesting that mindfulness training reduces the tendency to smoke in reaction to distress. Mindfulness might also reduce the likelihood that individuals respond to smoking urges by smoking. Researchers have theorized that one mechanism by which mindfulness improves psychological and physical health is enhanced self-regulation (e.g., Shapiro, Carlson, Astin, & Freedman, 2006). Specifically, mindfulness training should lead individuals to observe uncomfortable sensations (e.g., smoking urges) without reacting to them in impulsive, automatic ways (e.g., smoking; Bowen & Marlatt, 2009).

In the present study, female smokers either underwent a body image challenge (trying on a bathing suit) or participated in a control task (looking at a purse) while listening to brief mindfulness instructions (designed to increase state mindfulness) or silence. A model of hypothesized relationships between mindfulness, negative affect, and smoking after the body image challenge is shown in Figure 1. It was hypothesized that mindfulness would reduce negative affect, which would then lead to reductions in smoking urges and smoking behavior. It was also hypothesized that mindfulness would weaken the associations between negative affect and smoking urges and between smoking urges and smoking behavior. It was expected that negative affect would be less strongly related to smoking urges, and urges less strongly linked to smoking behavior, among participants receiving mindfulness instructions.

Methods

Participants

Female undergraduates ($n = 113$) at a large southeastern U.S. university who self-identified as smokers and were between the ages 18 and 26 attended the screening session. Participants were not required to smoke a certain number of cigarettes per day because college students are often light/nondaily smokers (Sutfin, Reboussin, McCoy, & Wolfson, 2009). Underweight and obese individuals were excluded from the experiment. Those with clinically elevated scores on self-report measures of eating disorders, body dissatisfaction, or depressive symptoms were excluded due to ethical issues of priming body dissatisfaction in vulnerable individuals and were referred to a local psychological services center (see below for greater detail). Based on the

Figure 1. Hypothesized relationships between body image challenge, negative affect, smoking urges, and smoking behavior. Mindfulness is hypothesized to reduce negative affect in response to a body image challenge, which should then lead to lower smoking urges and less likelihood of smoking behavior. Mindfulness is hypothesized to weaken the relationships between negative affect and smoking urges and between smoking urges and smoking behavior, after a body image challenge.

screening session, 75 women were eligible for the experimental session and 65 chose to participate.

Materials

Expired Carbon Monoxide (CO; Vitalograph Incorporated, Lenexa, KS, USA) levels were measured with a portable Vitalograph ecolyzer. CO levels of ≥ 8 parts per million (ppm) suggest recent smoking for heavier smokers (SRNT Subcommittee on Biochemical Verification, 2002).

The Smoking Status Questionnaire (SSQ) assesses demographics, smoking status, and nicotine dependence (using the *Fagerström Test for Nicotine Dependence* (FTND), a widely-used measure of nicotine dependence; Heatherton, Kozlowski, Frecker, & Fagerström, 1991).

The Smoking Stages of Change (SOC) is a three-item self-report measure that assesses desire and readiness to quit smoking. Participants are asked to report how many times they have quit smoking in the last year and to report if they are thinking of quitting smoking in the next year/in the next 30 days.

Participants indicated their typical clothing sizes (XS-XL) in the screening session; those in body image conditions were later given their selected size of bathing suit to try on.

The Body Shape Questionnaire (BSQ; Cooper, Taylor, Cooper, & Fairburn, 1987) is a 34-item self-report measure of body shape concern with good psychometric properties; the BSQ showed excellent reliability in the present study (Cronbach's alpha (α) = .96). BSQ scores of < 81 suggest little/no worry about body shape, scores of 81–110 suggest slight worry, scores of 111–140 suggest moderate worry, and scores > 140 suggest extreme worry about body shape (Cooper & Taylor, 1988). Participants who scored > 140 were excluded.

The Eating Attitudes Test (EAT-26; Garner, Olmsted, Bohr, & Garfinkel, 1982) is a 26-item self-report measure of eating disorder symptoms with good reliability and validity. Internal consistency in the present study was adequate (α = .82). Participants with scores ≥ 20 (associated with Anorexia Nervosa; Garner et al., 1982) were excluded.

The Bulimia Test-Revised (BULIT-R; Thelen, Farmer, Wonderlich, & Smith, 1991) is a psychometrically sound 36-item self-report measure of Bulimia Nervosa symptoms. Reliability in the present study was excellent (α = .93). Participants with scores ≥ 104 (associated with Bulimia Nervosa; Thelen et al., 1991) were excluded.

The Multifactorial Assessment of Eating Disorders Symptoms (MAEDS; Anderson, Williamson, Duchmann, Gleaves, & Barbin, 1999) is a 56-item self-report measure of symptoms associated with eating disorders. The MAEDS yields six subscale scores including Depression. As T-scores ≥ 70 are considered clinically elevated, participants with Depression subscale scores ≥ 70 were excluded. The Depression subscale showed good internal consistency in the present sample (α = .89). This subscale assesses symptoms of clinical depression (American Psychiatric Association, 2000) and is strongly related to other self-report measures of clinical depressive symptomatology (Anderson et al., 1999). Rather than using the other MAEDS subscales, the EAT-26 and BULIT-R (described above) were used as exclusion criteria for eating disorder symptoms because their cut-off scores have been specifically associated with anorexia nervosa and bulimia nervosa, respectively (Garner et al., 1982; Thelen et al., 1991).

The Five-Factor Mindfulness Questionnaire (FFMQ; Baer et al., 2006) is a 39-item self-report questionnaire of trait mindfulness. This measure was included to characterize the general level of trait mindfulness in the experimental sample. The scale has demonstrated adequate reliability and validity, and reliability in the present study was good (α = .89).

The Toronto Mindfulness Scale (TMS; Lau et al., 2006) is a 13-item self-report measure of state mindfulness that yields two factors: curiosity (attending to the present moment with an attitude of curiosity and openness) and decentering (observing thoughts/feelings without overidentifying with them). Because it was expected that brief mindfulness instructions would increase state (but not trait) mindfulness, the TMS was administered before and after manipulations and showed good internal consistency at both time points (M_α = .81).

The Questionnaire of Smoking Urges—Brief (QSU-brief; Cox, Tiffany, & Christen, 2001) is a reliable and valid 10-item measure of craving to smoke. The scale yields two factors: Factor 1 assesses desire to smoke in anticipation of pleasure, and Factor 2 measures smoking urges in attempt to relieve negative affect. In the present study, these subscales showed excellent reliability both before and after experimental manipulations (M_α = .92).

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item self-report measure of emotion. Participants rate each item (e.g., distressed, enthusiastic) from 1 (*very slightly/not at all*) to 5 (*extremely*). The PANAS yields two factors (positive and negative affect) and has good reliability and validity. Both factors showed good internal consistency in the present study (M_α = .81).

Visual Analogue Scales (VAS), as employed by [Lopez Khoury et al. \(2009\)](#), assessed smoking urges, affect, and body dissatisfaction. On each scale, participants were asked to indicate their response by drawing a vertical line through a 100-mm horizontal line.

Procedure

Procedures were reviewed and approved by the university's Institutional Review Board. Participants were recruited through on-campus fliers and the psychology participant pool. Female undergraduate smokers attended the screening session for either course credit or \$10 compensation. CO levels, height, and weight were measured. BMI was calculated as weight (kg) divided by height squared (m^2) and categorized as underweight: <18.5 ; normal weight: 18.5 – 24.9 ; overweight: 25 – 29.9 ; obesity: ≥ 30 (WHO, 2006). Participants completed the SSQ, SOC, Clothing Sizes, BSQ, EAT-26, BULIT-R, MAEDS, and FFMQ. Eligible participants (current smokers, EAT-26 < 26 , BULIT-R < 104 , BSQ < 140 , MAEDS Depression T < 70 , BMI 18.5 – 29.9) who wished to participate were scheduled for the experiment. Participants were asked to refrain from smoking for 6 hr before the experiment to induce a consistent level of nicotine deprivation. As nonsmoking was verified with expired CO, a 6-hr time period was chosen based on SRNT (2002) recommendations for amount of time required for CO level to decrease to below cut-off (typically 8–10 ppm) in current active smokers. Participants were told that the study examined factors that affect consumers' attitudes and preferences about products.

Participants were randomly assigned to one of four conditions: Purse + Silence, Body Image + Silence, Purse + Mindfulness, or Body Image + Mindfulness. The purse condition was included as a relatively neutral, non-body-image related comparison to the bathing suit, and silence was utilized for comparison to the effects of mindfulness instructions. Before experimental manipulations, participants completed the QSU-Brief, PANAS, VAS scales, and TMS. Next, participants either tried on a bathing suit or looked at a purse while listening to mindfulness instructions or in silence.

Body Image Conditions. Participants assigned to body image conditions tried on a black one-piece bathing suit alone in front of a full-length mirror with a divider for extra privacy.

Mindfulness Conditions. Participants in mindfulness conditions listened to two sets of mindfulness instructions on a tape player, each lasting 10 min. The first tape, adapted from [Kabat-Zinn \(1994, 2002\)](#) and [Baer et al. \(2006\)](#), instructed participants to focus on their breath, paying attention to their present experience with an attitude of nonjudgment and acceptance. Participants were encouraged to notice thoughts and emotions that arose, acknowledging them and letting them pass. Participants listened to a second set of mindfulness instructions while they tried on the bathing suit or looked at the purse. These instructions encouraged participants to use the same mindfulness skills they just learned to observe and describe their experience with the bathing suit or purse. The instructions for the body image condition incorporated [Delinsky and Wilson \(2006\)](#) recommendations for mindfulness-based ME. An expert in body image and mindfulness was consulted in creating the mindfulness instructions. Full transcripts of mindfulness tapes are available upon request. Below is a representative excerpt from mindfulness instructions while trying on the bathing suit:

As you observe your body in the mirror, mentally describe to yourself what you see. Make your goal be not to use any evaluative, critical, or judging words. Just observe and describe what you see with descriptive adjectives that do not represent "good" or "bad" labels, just noticing what is there. . . . Notice any thoughts that may come up, and simply observe them. . . . Try to do this with an attitude of acceptance, without judging your thoughts or feelings or anything about your experience—just being fully aware of what is happening and letting it be.

After experimental manipulations, participants completed the QSU-Brief, PANAS, VAS scales, and TMS. As a measure of smoking behavior, the experimenter offered each participant a pack of her preferred cigarettes, told her that she was welcome to take a smoke break, and recorded whether she accepted. Finally, participants were informed of the actual purpose of the study and questioned about any lingering psychological distress related to the body image challenge. None indicated significant distress.

Results

Overview of Analyses

Following preliminary analyses (descriptive characteristics, identification of covariates, manipulations checks), results are described for the three primary dependent variables of interest: negative affect, smoking urges, and smoking behavior. Repeated-measures mixed-model multivariate analyses of covariance (MANCOVAs) were used to assess effects of experimental conditions on continuous variables (negative affect and smoking urges), and binary logistic regression was utilized to predict the dichotomous variable (smoking behavior). Fisher's z transformations ([Winterbottom, 1979](#)) were used to statistically compare associations between negative affect, smoking urges, and smoking behavior as a function of experimental condition. Multiple regression analyses were planned to examine the roles of negative affect and urges as mediators of relationships between mindfulness and smoking (see [Figure 1](#)). However, because mindfulness was not directly related to smoking urges or likelihood of smoking (described below), statistical criteria for mediation were not met ([Baron & Kenny, 1986](#)). All analyses were conducted using PASW Statistics 18. Experimental data were checked for assumptions, and univariate and multivariate outliers greater than 3.3 standard deviations above the mean were excluded ([Tabachnick & Fidell, 2007](#)).

Participant Characteristics

Of 113 participants who completed screening, 75 (66.4%) were eligible for the experiment, and 65 chose to participate for course credit ($n = 56$; 86%) or monetary compensation ($n = 9$; 14%). Reasons for exclusion were underweight ($n = 1$), obese ($n = 9$), elevated EAT-26 ($n = 7$), BULIT-R ($n = 2$), BSQ ($n = 12$), and Depression ($n = 6$). Chi-square analyses and t -tests indicated that women who participated did not differ from those who declined on demographics or variables of interest, $ps > .05$. One participant reported that she had not smoked for 96 hr before the experiment ($> 3.3 SD$). Since this level of nicotine deprivation was extremely different from the rest of the sample and likely to affect smoking urges, this case was deleted.

Table 1. Baseline Characteristics for Total Sample and by Experimental Group

	Total (<i>N</i> = 64)	PS (<i>n</i> = 16)	BS (<i>n</i> = 15)	PM (<i>n</i> = 15)	BM (<i>n</i> = 18)	<i>p</i>
Age	20.03 (1.77)	20.25 (1.81)	20.33 (1.95)	20.20 (1.52)	19.44 (1.79)	.43
% Caucasian	87.5%	93.8%	86.7%	86.7%	83.3%	.36
BMI	22.72 (2.56)	23.46 (3.23)	23.53 (2.11)	22.01 (2.39)	21.99 (2.14)	.14
BSQ	80.66 (26.37)	88.25 (23.33)	80.67 (20.08)	75.40 (30.94)	78.28 (29.86)	.57
% Daily smokers	78.1%	75.0%	86.7%	73.3%	77.8%	.82
Cigarettes/week	48.95 (35.81)	50.71 (40.34)	51.67 (34.04)	40.44 (25.48)	52.43 (42.07)	.78
FTND	1.59 (1.67)	1.57 (1.45)	1.29 (1.54)	1.85 (2.08)	1.67 (1.71)	.86
CO screening	5.65 (4.48)	6.16 (5.25)	5.20 (3.17)	6.47 (4.84)	4.89 (4.55)	.72
CO experimental	3.51 (3.74)	3.53 (3.04)	4.00 (4.42)	3.53 (4.53)	3.06 (3.13)	.92
Hours since last cigarette	14.56 (7.92)	13.27 (4.30)	14.93 (7.76)	12.23 (4.34)	17.25 (11.59)	.29
Considering quitting in next 6 months	49.2%	50%	57.1%	40.0%	50.0%	.84
Planning to quit in next 30 days	12.7%	12.5%	7.1%	13.3%	16.7%	.89
Quit for 24 hr in past year	71.4%	68.8%	71.4%	86.7%	61.1%	.45
FFMQ	126.32 (13.34)	128.88 (15.97)	128.93 (13.56)	127.67 (13.08)	120.21 (10.05)	.24

Note. PS = Purse + Silence; BS = Body Image + Silence; PM = Purse + Mindfulness; BM = Body Image + Mindfulness; BMI = Body Mass Index; BSQ = Body Shape Questionnaire; FTND = Fagerström Test for Nicotine Dependence; CO = Carbon Monoxide level in parts per million (ppm); FFMQ = Five-factor Mindfulness Questionnaire. Standard deviations are given in parentheses.

p values are shown for ANOVAs and chi-square analyses testing differences between conditions on continuous and categorical variables, respectively.

Participants included in analyses (*N* = 64) had a mean age of 20.03 (± 1.77) and were 87.5% Caucasians. The majority (*n* = 50; 78.1%) were daily smokers who reported smoking an average of 8.30 cigarettes/day (± 4.74 ; range 2–20). Nondaily smokers (*n* = 15) indicated smoking an average of 16.38 cigarettes/week (± 24.13). Average BMI was in the normal range ($M = 22.72 \pm 2.56$). Chi-square analyses and one-way analyses of variance (ANOVAs) indicated that experimental groups did not differ on baseline variables including trait mindfulness ($ps \geq .14$, Table 1). Pre- and postmanipulation descriptive characteristics are shown in Table 2.

Identification of Covariates

Bivariate correlations were conducted between baseline/demographic variables and dependent variables. BSQ and BMI were related to greater VAS body dissatisfaction ($rs: .26-.59$, $ps < .05$). Participants with higher BMIs were less likely to accept the experimenter's offer to smoke, $r = -.31$, $p = .01$. Minority status was related to more positive affect ($r = .27$, $p = .03$), higher state mindfulness ($r = .29$, $p = .02$), less body dissatisfaction ($r = -.30$, $p = .02$), planning to wait longer until smoking ($r = .35$, $p = .003$), and less likelihood of accepting the experimenter's offer to smoke, $r = -.28$, $p = .03$. Smoking frequency was related to higher smoking urges ($rs: .37-.47$, $ps < .01$) and planning to smoke sooner after the experiment ($r = -.28$, $p = .03$). Baseline variables that were correlated with dependent variables at the .05 level were controlled in later analyses (Weinfurt, 2004; Tabachnick & Fidell, 2007).

Manipulation Check: State Mindfulness

Repeated-measures mixed-model analyses of covariance (ANCOVAs) were conducted to examine changes in state mindfulness (TMS Decentering and Curiosity scores) from pre- to postmanipulation by condition. Results indicated an interaction between pre-post TMS Decentering scores (state mindfulness) and mindfulness instruction condition, $F(1,59) = 9.61$, $p = .003$, $\eta^2 = .14$. As expected, whereas Decentering scores increased

in groups who received mindfulness instructions ($t(32) = 4.65$, $p < .001$), they did not change in silence groups, $p = .12$. There was also an interaction between pre-post Curiosity scores and mindfulness instructions, $F(1, 59) = 6.40$, $p = .01$, $\eta^2 = .10$. Curiosity scores increased to a greater extent in the mindfulness instructions than silence conditions (mindfulness instructions: $t(32) = 5.35$, $p < .001$; silence: $t(30) = 3.05$, $p = .01$).

Manipulation Check: Body Dissatisfaction

A repeated-measures mixed-model ANCOVA was used to examine within-subject changes in body dissatisfaction (VAS) from pre- to postmanipulation by condition. As expected, results indicated an interaction between pre-post body dissatisfaction, mindfulness instructions, and body image, $F(1, 56) = 7.35$, $p = .009$, $\eta^2 = .12$. Whereas body dissatisfaction decreased in the Purse + Silence group, $t(14) = 2.11$, $p = .05$, body dissatisfaction increased in the Body Image + Silence group, $t(14) = 2.40$, $p = .03$. Body dissatisfaction did not change in the Purse + Mindfulness group ($p = .34$) or the Body Image + Mindfulness group ($p = .96$). These results suggest that the body image challenge did indeed increase body dissatisfaction but that mindfulness ameliorated this effect. For means and standard deviations, see Table 1.

Negative Affect

A repeated-measures MANCOVA was conducted to examine changes in affect (PANAS negative affect and VAS) over time by condition. Between-subjects factors were dichotomized mindfulness condition and dichotomized body image condition. There was an interaction between pre-post VAS Affect, mindfulness instructions, and body image condition, $F(3,55) = 3.68$, $p = .02$, $\eta^2 = .03$. Whereas affect became more positive in the Purse + Silence group, $t(14) = 3.65$, $p = .003$, affect became more negative in the Body Image + Silence group, $t(14) = 2.79$, $p = .01$. Affect ratings did not change in either of the mindfulness

Table 2. Mindfulness, Body Dissatisfaction, Affect, and Smoking Urges Pre- and Postexperimental Manipulations by Condition

	PS (<i>n</i> = 16)	BS (<i>n</i> = 15)	PM (<i>n</i> = 15)	BM (<i>n</i> = 18)
<i>State mindfulness</i>				
TMS-Decenter (Pre)	13.06 (5.11)	12.27 (3.79)	12.67 (6.37)	12.11 (5.89)
TMS-Decenter (Post)	13.81 (6.57)	13.60 (3.18)	17.73 (4.67)	17.39 (5.10)
TMS-Curiosity (Pre)	11.63 (5.26)	12.53 (4.45)	11.13 (4.84)	11.06 (5.36)
TMS-Curiosity (Post)	13.13 (6.77)	14.73 (3.81)	15.93 (4.51)	15.06 (5.95)
<i>Body dissatisfaction</i>				
VAS (pre)	45.47 (19.99)	37.60 (17.17)	32.53 (20.04)	40.17 (23.48)
VAS (post)	40.77 (19.62)	42.53 (18.29)	34.20 (18.05)	40.31 (23.35)
<i>Affect</i>				
VAS affect (pre)	53.27 (14.45)	61.00 (9.99)	56.60 (11.52)	53.69 (15.34)
VAS affect (post)	58.80 (16.73)	54.02 (11.94)	57.43 (11.00)	52.72 (18.23)
PANAS negative affect (pre)	15.31 (5.08)	13.87 (2.56)	14.67 (2.58)	16.33 (6.56)
PANAS negative affect (post)	14.31 (5.20)	14.60 (4.98)	13.53 (2.70)	14.51 (4.05)
<i>Smoking urges</i>				
QSU-Negative affect (pre)	21.50 (18.73)	25.60 (20.32)	26.95 (24.77)	24.59 (23.44)
QSU-Negative affect (post)	26.25 (23.81)	30.43 (26.88)	28.73 (25.98)	19.89 (21.22)
QSU-Desire (pre)	59.51 (22.73)	63.07 (28.31)	68.67 (24.81)	63.49 (29.11)
QSU-Desire (post)	64.31 (30.60)	65.91 (32.75)	66.33 (31.58)	57.78 (30.97)
VAS Urge (pre)	59.33 (10.78)	60.20 (18.93)	57.07 (19.70)	59.11 (22.87)
VAS Urge (post)	60.73 (15.49)	61.40 (17.36)	50.40 (16.64)	58.06 (21.22)
Correlation between negative affect (PANAS) and smoking urges (QSU-Negative affect)	$r = .73^{**}$	$r = .66^{**}$	$r = .43^{ns}$	$r = .24^{ns}$
Correlation between smoking urges (QSU-Negative affect) and smoking behavior	$r = -.10^{ns}$	$r = .66^*$	$r = .48^{ns}$	$r = -.03^{ns}$

Note. PS = Purse + Silence; BS = Body Image + Silence; PM = Purse + Mindfulness; BM = Body Image + Mindfulness; TMS = Toronto Mindfulness Scale; VAS = Visual Analogue Scale; PANAS = Positive and Negative Affect Schedule. Standard deviations are given in parentheses.

$**p \leq .001$, $*p \leq .01$.

groups, $ps > .71$. In other words, mindfulness did not reduce negative affect but prevented the body image challenge from influencing affective experience. For means and standard deviations, see Table 2.

Smoking Urges

There were no effects of experimental conditions on smoking urges, $ps > .40$ (dependent variables: QSU-Negative Affect, QSU-Desire, VAS Urges). However, mindfulness appeared to attenuate the association between negative affect and smoking urges. For participants in nonmindfulness conditions ($n = 31$), the correlation between PANAS negative affect and smoking urges (QSU-Negative Affect) for negative affect reduction was .70 ($p < .001$). Consistent with hypotheses, the correlation was lower and not statistically significant among participants in mindfulness conditions ($n = 33$, $r = .27$, $p = .13$). Fisher's z transformation indicated that the correlations among the non-mindfulness ($z' = .87$, $SE_{z'} = .19$) and the mindfulness groups ($z' = .28$, $SE_{z'} = .18$) were significantly different from one another ($z = 12.04$, $p < .05$; see Table 2 for correlations by experimental group).

Smoking Behavior

On Step 1 of the binary logistic regression analysis predicting participants' likelihood of accepting the experimenter's offer to smoke, covariates were entered. On Step 2, body image and

mindfulness conditions were entered. On Step 3, the interaction term (product of body image and mindfulness) was entered. There were no significant effects of experimental conditions in predicting smoking behavior, $ps > .11$.

However, consistent with hypotheses, mindfulness appeared to weaken the association between smoking urges and behavior among participants who tried on a bathing suit. Correlations between urges to smoke to relieve negative affect (QSU – Negative Affect) and smoking behavior did not differ significantly between non-mindfulness ($r = .34$, $p = .07$) and mindfulness groups ($r = .18$, $p = .32$) in the sample as a whole ($z = .68$, $p = .50$). However, the effect of mindfulness on the association between urges and behavior was most striking (and statistically significant) among participants who tried on a bathing suit, $z = 2.07$, $p = .04$. Whereas urges were linked to greater likelihood of smoking behavior among participants trying on a bathing suit in silence ($r = .66$, $z' = .79$, $SE_{z'} = .30$, $p = .01$), there was no association among those who tried on the bathing suit with mindfulness instructions ($r = -.03$, $z' = -.03$, $SE_{z'} = .26$, $p = .90$). See Table 2 for correlations by experimental group.

Discussion

The current results suggest that brief mindfulness instructions can change the way that female smokers respond to a body image

challenge. Mindfulness instructions increased self-reported state mindfulness and prevented increases in body dissatisfaction and negative affect associated with trying on a bathing suit. Mindfulness did not affect participants' self-reported urges to smoke or likelihood of accepting the experimenter's offer to smoke. However, mindfulness weakened the relationship between negative affect and smoking urges. Among participants who did not receive mindfulness instructions, negative affect was strongly associated with higher urges to smoke in attempt to relieve negative affect. Among participants who were encouraged to respond mindfully, negative affect did not predict smoking urges. Mindfulness also appeared to reduce the likelihood that participants responded to smoking urges by smoking after the body image challenge.

Results suggest that mindfulness did not lead to lessened negative affect but prevented the body image challenge from increasing negative affect. This is consistent with research indicating that mindfulness reduces the extent to which exposure to negatively valenced stimuli affects emotional experience (Arch & Craske, 2006). This finding is striking given past literature suggesting that body image stimuli reliably increase negative affect among women (e.g., Lopez Khoury et al., 2009; Pinhas et al., 1999). One explanation is that mindfulness prevents biased information processing related to body image stimuli, reducing the likelihood that exposure to these stimuli increases distress (Stewart, 2004). Future research should assess participants' extent of biased information processing (e.g., using an implicit attitudes test) to test this explanation.

Experimental conditions did not affect whether participants accepted the experimenter's offer to smoke. This could be due to the measure of smoking behavior employed. Future research should investigate the effects of mindfulness on smoking behavior using more sensitive (e.g., smoking topography) and externally valid assessments (e.g., smoking frequency during specified time periods). In addition, some unexpected results emerged: body dissatisfaction decreased and negative affect increased in the Purse + Silence condition. It is unclear why observing a purse in silence would produce any changes in body dissatisfaction or affect. Future research should examine effects of a similar condition using larger sample sizes.

The hypothesis that mindfulness would weaken the relationship between negative affect and urges was supported. Among participants who received mindfulness, the association between negative affect and smoking urges was much lower and not statistically significant. This finding is particularly important given that research clearly suggests that negative affect is a common trigger for smoking urges (e.g., Baker et al., 2004; Brandon, 1994; Brandon et al., 1996; Payne et al., 1991). Mindfulness prevented this well-documented relationship between negative affect and smoking urges, consistent with findings by Bowen and Marlatt (2009). Similarly, Witkiewitz & Bowen (2010) and Witkiewitz, Bowen, & Donovan (2011) found that mindfulness training for coping with craving attenuated the association between depressive symptoms and craving among substance-dependent individuals. The present results also support the hypothesis that mindfulness would reduce the likelihood of smoking in response to smoking urges to relieve negative affect after a body image challenge. This is consistent with hypotheses that mindfulness promotes improved self-regulation (Shapiro et al., 2006), particularly in the face of unpleasant sensations such as smoking urges (Bowen & Marlatt, 2009).

Limitations of the present study include a relatively small sample size, homogeneous sample (i.e., primarily Caucasian college students), and a sample of light smokers. This study should be replicated with larger sample sizes and more diverse populations. The proposed model (Figure 1) should be tested using more complex statistical techniques that can test for moderated mediation (e.g., structural equation modeling [SEM]; Kline, 2011; Preacher, Rucker, & Hayes, 2007). Unfortunately, our small sample size will not allow for a reliable test of such complex models (Kline, 2011). The present study is also limited by assessment of constructs at only one point in time. Although we propose that mindfulness lessens the extent to which negative affect triggers smoking urges, it is also possible that mindfulness reduces the extent to which smoking urges affect emotional experiences (see Nosen & Woody, 2009 for a discussion of reactions to smoking urges). Future research should examine the effects of similar mindfulness instructions using longitudinal designs with longer follow-up periods. Finally, the use of silence as the control comparison for mindfulness instructions presents a limitation. The apparent effects of mindfulness instructions could also be related to more general factors related to listening to a voice recording (e.g., distraction). The finding that self-reported state mindfulness increased in the mindfulness conditions relative to the silence conditions supports the argument that our results are due to mindfulness instructions rather than distraction. However, future research should include more active control conditions (e.g., neutral audio recordings; Ditto, Eclache, & Goldman, 2006) and compare mindfulness to other empirically supported strategies (e.g., CBT).

Although results should be replicated with larger, more diverse samples, these preliminary findings lend support for the use of mindfulness strategies for helping female smokers to cope with body image stimuli. Furthermore, results provide information about potential mechanisms underlying benefits of mindfulness for smokers. For example, mindfulness might weaken the association between negative affect and urges. In addition, mindfulness may reduce the likelihood of smoking in response to smoking urges when female smokers are faced with body image stimuli. Given past research suggesting strong interconnections between negative affect, smoking urges, and smoking behavior, mindfulness might be a particularly useful strategy for breaking these associations. Mindfulness-based interventions that help weight-concerned female smokers to cope with body dissatisfaction, negative affect, and smoking urges may enhance both psychosocial functioning and smoking cessation outcomes.

Funding

This work was conducted at Louisiana State University and supported in part by a grant to C.E.A. from the American Psychological Association (2010 American Psychological Association Dissertation Research Award). C.E.A. is now at the University of Texas MD Anderson Cancer Center and is supported in part by the National Cancer Institute through a cancer prevention fellowship (R25T CA57730, PI: Shine Chang, Ph.D.) and MD Anderson's Cancer Center Support Grant CA016672.

Declaration of Interests

None declared.

References

- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.
- Anderson, D. A., Williamson, D. A., Duchmann, E. G., Gleaves, D. H., & Barbin, J. M. (1999). Development and validation of a multifactorial treatment outcome measure for eating disorders. *Assessment*, 6, 7–20. doi:10.1177/107319119900600102
- Arch, J. J., & Craske, M. G. (2006). Mechanisms of mindfulness: Emotion regulation following a focused breathing induction. *Behaviour Research and Therapy*, 44, 1849–1858. doi:10.1016/j.brat.2005.12.007
- Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment*, 13, 27–45. doi:10.1177/1073191105283504
- Baker, T. B., Piper, M. E., McCarthy, D. E., Majeskie, M. R., & Fiore, M. C. (2004). Addiction motivation reformulated: An affective processing model of negative reinforcement. *Psychological Review*, 111, 33–51. doi:10.1037/0033-295X.111.1.33
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173–1182. doi:10.1037//0022-3514.51.6.1173
- Bowen, S., & Marlatt, A. (2009). Surfing the urge: Brief mindfulness-based intervention for college students. *Psychology of Addictive Behaviors*, 23, 666–671. doi:10.1037/a0017127
- Brandon, T. H. (1994). Negative affect as motivation to smoke. *Current Directions in Psychological Science*, 3, 33–37. doi:10.1111/1467-8721.ep10769919
- Brandon, T. H., Wetter, D. W., & Baker, T. B. (1996). Affect, expectancies, urges, and smoking: Do they conform to models of drug motivation and relapse? *Experimental and Clinical Psychopharmacology*, 4, 29–36. doi:10.1037//1064-1297.4.1.29
- Brewer, J. A., Mallik, S., Babuscio, T. A., Nich, C., Johnson, H. E., Deleone, C. M., . . . Rounsaville, B. J. (2011). Mindfulness training for smoking cessation: Results from a randomized controlled trial. *Drug and Alcohol Dependence*, 119, 72–80. doi:10.1016/j.drugalcdep.2011.05.027
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84, 822–848. doi:10.1037/0022-3514.84.4.822
- Centers for Disease Control and Prevention (2002). Women and smoking: A report of the surgeon general; executive summary. *Morbidity and Mortality Weekly Report*, 51, 1–13.
- Cooper, P. J., & Taylor, M. J. (1988). Body image disturbance in bulimia nervosa. *British Journal of Psychiatry*, 153, 32–36.
- Cooper, P. J., Taylor, M. J., Cooper, Z., & Fairburn, C. G. (1987). The development and validation of the Body Shape Questionnaire. *International Journal of Eating Disorders*, 6, 485–494. doi:10.1002/1098-108X(198707)6:4<485::AID-EAT2260060405>3.0.CO;2-O
- Cox, L. S., Tiffany, S. T., & Christen, A. G. (2001). Evaluation of the brief questionnaire of smoking urges (QSU-brief) in laboratory and clinical settings. *Nicotine & Tobacco Research*, 3, 7–16. doi:10.1080/14622200020032051
- Davis, J. M., Fleming, M. F., Bonus, K. A., & Baker, T. B. (2007). A pilot study on mindfulness based stress reduction for smokers. *BMC Complementary and Alternative Medicine*, 7, 2–8.
- Delinsky, S. S., & Wilson, G. T. (2006). Mirror exposure for the treatment of body image disturbance. *International Journal of Eating Disorders*, 39, 108–116. doi:10.1002/eat.20207
- Ditto, B., Eclache, M., & Goldman, N. (2006). Short-term autonomic and cardiovascular effects of mindfulness body scan meditation. *Annals of Behavioral Medicine*, 32, 227–234. doi:10.1207/s15324796abm3203_9
- Garner, D. M., Olmsted, M. P., Bohr, Y., & Garfinkel, P. E. (1982). The Eating Attitudes Test: Psychometric features and clinical correlates. *Psychological Medicine*, 12, 871–878. doi:10.1017/S0033291700030762
- Groesz, L. M., Levine, M. P., & Murnen, S. K. (2002). The effect of experimental presentation of thin media images on body satisfaction: A meta-analytic review. *International Journal of Eating Disorders*, 31, 1–16. doi:10.1002/eat.10005
- Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerström, K. O. (1991). The Fagerström test for nicotine dependence: A revision of the Fagerström tolerance questionnaire. *British Journal of Addiction*, 86, 1119–1127. doi:10.1111/j.1360-0443.1991.tb01879.x
- Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. New York: Delacourt.
- Kabat-Zinn, J. (1994). *Wherever you go, there you are: Mindfulness and meditation in everyday life*. New York: Hyperion.
- Kabat-Zinn, J. (2002). *Sitting meditations. On Guided mindfulness meditation* [compact disc]. Lexington, MA: Stress Reduction CDs and Tapes.
- Kendzor, D. E., Adams, C. E., Stewart, D. W., Baillie, L. E., & Copeland, A. C. (2009). Cigarette smoking is associated with body shape concerns and bulimia symptoms among young adult females. *Eating Behaviors*, 10, 56–58. doi:10.1016/j.eatbeh.2008.10.012
- King, T. K., Matacin, M., Marcus, B. H., Bock, B. C., & Tripolone, J. (2000). Body image evaluations in women smokers. *Addictive Behaviors*, 25, 613–618. doi:10.1016/S0306-4603(99)00039-8
- King, T. K., Matacin, M., White, K. S., & Marcus, B. H. (2005). A prospective examination of body image and smoking cessation in women. *Body Image*, 2, 19–28. doi:10.1016/j.bodyim.2005.01.003
- Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York: Guilford.

- Lau, M. A., Bishop, S. R., Segal, Z. S., Buis, T., Anderson, N. D., Carlson, L., . . . Devins, J. (2006). The Toronto mindfulness scale: Development and validation. *Journal of Clinical Psychology*, 62, 1445–1467. doi:10.1002/jclp.20326
- Levine, M. D., Marcus, M. D., & Perkins, K. A. (2003). Women, weight, and smoking: A cognitive-behavioral approach to women's concerns about weight gain following smoking cessation. *Cognitive and Behavioral Practice*, 10, 105–111. doi:10.1016/S1077-7229(03)80018-4
- Lopez, E. N., Drobos, D. J., Thompson, J. K., & Brandon, T. H. (2008). Effects of a body image challenge on smoking motivation among college females. *Health Psychology*, 27, S243–S251. doi:10.1037/0278-6133.27.3(Suppl.).S243
- Lopez Khoury, E. N., Litvin, E. B., & Brandon, T. H. (2009). The effect of body image threat on smoking motivation among college women: Mediation by negative affect. *Psychology of Addictive Behaviors*, 23, 279–286. doi:10.1037/a0014291
- Payne, T. J., Schare, M. L., Levis, D. J., & Colletti, G. (1991). Exposure to smoking-relevant cues: Effects on desire to smoke and topographical components of smoking behavior. *Addictive Behaviors*, 16, 467–479. doi:10.1016/0306-4603(91)90054-L
- Perkins, K. A., Marcus, M. D., Levine, M. D., D'Amico, D., Miller, A., Broge, M., . . . Shiffman, S. (2001). Cognitive-behavioral therapy to reduce weight concerns improves smoking cessation outcome in weight-concerned women. *Journal of Consulting and Clinical Psychology*, 69, 604–613. doi:10.1037/0022-006X.69.4.604
- Pinhas, L., Toner, B. B., Ali, A., Garfinkel, P. E., & Stuckless, N. (1999). The effects of the ideal of female beauty on mood and body satisfaction. *International Journal of Eating Disorders*, 25, 223–226. doi:10.1002/(SICI)1098-108X(199903)25:2<223::AID-EAT12>3.0.CO;2-B
- Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research*, 42, 185–227. doi:10.1080/00273170701341316
- Shapiro, S. L., Carlson, L. E., Astin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology*, 62, 373–386. doi:10.1002/jclp.20237
- SRNT Subcommittee on Biochemical Verification. (2002). Biochemical verification of tobacco use and cessation. *Nicotine and Tobacco Research*, 4, 149–159.
- Stewart, T. (2004). Light on body image treatment: Acceptance through mindfulness. *Behavior Modification*, 28, 783–811. doi:10.1177/0145445503259862
- Stice, E., & Shaw, H. (2003). Prospective relations of body image, eating, and affective disturbances to smoking onset in adolescent girls: How Virginia slims. *Journal of Consulting and Clinical Psychology*, 71, 129–135. doi:10.1037/0022-006X.71.1.129
- Sutfin, E. L., Reboussin, B. A., McCoy, T. P., & Wolfson, M. (2009). Are college student smokers really a homogenous group? A latent class analysis of college student smokers. *Nicotine and Tobacco Research*, 1, 444–454. doi:10.1093/ntr/ntp006
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Pearson.
- Thelen, M. H., Farmer, J., Wonderlich, S., & Smith, M. (1991). A revision of the Bulimia Test: The BULIT-R. *Psychological Assessment*, 3, 119–124. doi:10.1037/1040-3590.3.1.119
- Vidrine, J. I., Businelle, M. S., Cincirpini, P., Li, Y., Marcus, M. T., Waters, A. J., . . . Wetter, D. W. (2009). Associations of mindfulness with nicotine dependence, withdrawal, and agency. *Substance Abuse*, 30, 318–327. doi:10.1080/08897070903252973
- Waters, A. J., Reitzel, L. R., Cincirpini, P., Li, Y., Marcus, M. T., Vidrine, J. I., & Wetter, D. W. (2009). Associations between mindfulness and implicit cognition and self-reported affect. *Substance Abuse*, 30, 328–337. doi:10.1080/08897070903252080
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063–1070. doi:10.1037//0022-3514.54.6.1063
- Weinfurt, K. P. (2004). Multivariate analysis of variance. In L. G. Grimm & P. R. Yarnold (Eds.), *Reading and understanding multivariate statistics* (pp. 245–276). Washington, DC: American Psychological Association.
- Westbrook, C., Creswell, J. D., Tabibnia, G., Julson, E., Kober, H., & Tindle, H. A. (2011). Mindful attention reduces neural and self-reported cue-induced craving in smokers. *Social Cognitive and Affective Neuroscience Advance Access*. doi:10.1093/scan/nsr076
- Wilson, G. T. (1999). Cognitive behavior therapy for eating disorders: Progress and problems. *Behaviour Research and Therapy*, 37, S79–S95.
- Wilson, G. T. (2004). Acceptance and change in the treatment of eating disorders: The evolution of manual-based cognitive-behavioral therapy. In S. C. Hayes, V. M. Follette, & M. M. Linehan (Eds.), *Mindfulness and acceptance: Expanding the cognitive-behavioral tradition* (pp. 243–260). New York: Guilford.
- Winterbottom, A. (1979). A note on the derivation of Fisher's transformation of the correlation coefficient. *American Statistician*, 33, 142–143. doi:10.2307/2683819
- Witkiewitz, K., & Bowen, S. (2010). Depression, craving, and substance use following a randomized trial of mindfulness-based relapse prevention. *Journal of Consulting and Clinical Psychology*, 78, 362–374. doi:10.1037/a0019172
- Witkiewitz, K., Bowen, S., & Donovan, D. M. (2011). Moderating effects of a craving intervention on the relation between negative mood and heavy drinking following treatment for alcohol dependence. *Journal of Consulting and Clinical Psychology*, 79, 54–63. doi:10.1037/a0022282
- World Health Organization. (2006). Global Database on Body Mass Index. BMI Classification. Retrieved from http://apps.who.int/bmi/index.jsp?introPage=intro_3.html