Emotion Regulation and Health Behavior: Effects of Negative Affect

and Emotion Regulation Strategies on Eating and Smoking

A DISSERTATION SUBMITTED TO THE FACULTY OF THE GRADUATE

SCHOOL OF THE UNIVERSITY OF MINNESOTA BY

Nora Kathleen Keenan

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

Advisors: Patricia A. Frazier and Alexander J. Rothman

January 2013

Acknowledgments

It takes a village to raise a psychologist, and I am extremely grateful to everyone who has contributed to my growth and development as a psychologist.

I would particularly like to extend my thanks and deep appreciation to my advisors and my committee:

My advisor Pat Frazier, Ph.D. for your unfailing support and encouragement over the years. You have believed in me, pushed me to be my best, and I am a far better psychologist and forever grateful for it. Your meticulousness and integrity of research have forever set the standard for me.

My advisor Alex Rothman, Ph.D. for your ongoing support in navigating my way along an inter- (or is it multi- ?) disciplinary path. You taught me that in critical thinking, nothing takes the place of a good theory (or three), a scrawled diagram, and plenty of spirited Rothman lab discussions. Your precision of language has pushed me to become a far better writer and communicator, something I will always deeply value.

Mark Snyder, Ph.D. for serving as my committee chair and for welcoming me into the Social area. You helped me develop confidence in myself as a psychologist and become a more focused, effective teacher.

Matt Kushner, Ph.D. for your generosity in serving on my committee, and even more, for your clinical mentorship and support in my development as a psychologist. You have taught me so much about the importance of systemic thinking, structured treatment, and balancing the art within the science of practice.

Clinical Supervisors
Many thanks also to my other clinical practicum supervisors over the years, particularly Linda Van Egeran, Ph.D., Trisha Stark, Ph.D., and Jerry Shih, Ph.D.

Tremendous thanks are also due to Jim Hart, Ph.D., my excellent internship training director, as well as other internship mentors and supervisors, including Heather Smith, Ph.D., M. Christina Hove, Ph.D., Colleen Heinkel, Ph.D., and most especially Roger Williams, Ph.D., for his outstanding mentoring and support. Dr. Williams challenged me to continue my development in systemic thinking, and has modeled and taught me the importance of balancing effective scientific functioning with a rawly compassionate presence.

Consultation
Thanks to Traci Mann, Ph.D., for her consultation on the implementation of the taste task in Study 1. Her expertise was invaluable and I'm sure saved me from many potential

Abstract

Negative affect (NA) and deficits in emotion regulation (ER) are associated with poorer behavioral self-regulation across multiple health domains. Specifically, people who report more NA and have difficulty regulating negative emotions are more likely to engage in emotional eating and eating disordered behavior. Among smokers, NA is associated with higher rates of smoking and more difficulty with cessation. Though ER approaches vary in effectiveness, implementing ER strategies is one promising way of improving self-regulation of eating and other health behaviors. The current research compares the effects of several ER strategies on distress and eating behavior (Study 1), and compares ER skills of smokers versus nonsmokers (Study 2). In Study 1, participants ($N = 114$) were assigned to one of four ER conditions (suppression, cognitive reappraisal, mindfulness, and a no-instruction control), watched a movie clip to induce NA, and completed a tasting activity. Results showed that, compared to mindfulness or reappraisal, suppression was associated with eating more sweets; furthermore, this effect was stronger for those people naturally tending toward suppression or emotional eating. Study 2 compared ER profiles of daily smokers ($N = 99$) and nonsmokers from Study 1 ($N = 114$). Results indicated that, compared to nonsmokers, smokers had significantly poorer ER skills and relied on less effective ER strategies (e.g., suppression). In sum, this research provides a stepping-stone toward improved interventions to facilitate behavioral change processes by linking habitual ER vulnerabilities to health risk behaviors and providing a controlled lab-based test of different ER strategies on health behavior regulation.

Table of Contents

List of Tables

List of Figures

Overview of the Dissertation

The research reported herein aimed to elucidate the effects of negative affect and different strategies for the regulation of negative emotions on specific health behaviors. The dissertation is organized as follows. First, a general overview of emotion regulation theories is provided. Then, the results of two studies of emotion regulation and health are reported, each focusing on a different health risk behavior.

In Study 1, which used a translational experimental lab design, the target outcome was eating behavior. Participants were assigned to use one of three specific emotion regulation strategies or to a no-instruction control condition during a laboratory negative affect emotion-induction procedure. These emotion regulation instructions were first validated in a pilot study, also reported here (see Appendix B). Outcome measures included the amount of three different snack foods consumed, as well as reported distress and negative affect.

In Study 2, the target health risk behavior was smoking. Affective and emotion regulation profiles of smokers were assessed and compared to those of the nonsmokers who completed the same measures in Study 1. Additionally, I examined the relations between 1) negative affect and smoking behavior and 2) emotion regulation and smoking behavior.

For each study, I review the health consequences of the behavior and its associations with stress and negative affect, discuss emotion regulation theories as applied to behavioral health, and then review the literature on three key emotion regulation strategies (emotional suppression, cognitive reappraisal, and mindfulness) and

the target health outcome. Finally, for each study, the method, results, conclusions, implications, and limitations are detailed.

Emotion Regulation Literature Review

What is Emotion Regulation?

Emotion regulation has been considered both a subtype of behavioral self-regulation (e.g., Vohs & Heatherton, 2000) and a subtype of coping (Skinner, Edge, Altman, & Sherwood, 2003). According to Skinner and colleagues, emotion regulation involves active efforts to reduce distress and constructively express emotions. It is worth noting that, within the coping literature, emotion regulation is conceptually distinct from "emotion-focused coping", the unfavorably-viewed unregulated discharge of (typically negative) emotions. In contrast, emotion regulation is viewed as a constructive approach to managing emotions (Skinner et al., 2003). Emotion regulation is one class of coping strategies that is theorized to decrease impairment in decision-making in the context of dysregulated eating behavior, smoking cessation, and substance abuse relapse prevention, and is thus a promising avenue for exploring differences in behavioral self-regulation in health domains.

Theories of Emotion Regulation

One perspective on emotion regulation comes from the work of Carver and Scheier (1998), who view emotions as "error signals" in a continuous feedback loop designed to cue people to change their behavior when it is discrepant from their ideals or the trajectory is not in line with targeted goals. Negative affect and distress, from this framework, are signals to take action to return to an emotional homeostasis or

equilibrium. To the extent that reducing negative affect or distress is viewed as urgent and prioritized, there is likely to be greater risk of sacrificing longer-term effortful behavioral self-regulation goals in favor of returning one's current emotional status to a comfortable level.

Despite Skinner et al.'s (2003) overall positive characterization of emotion regulation, researchers have found that some strategies are more effective than others in reducing distress. Thus, emotion regulation is not a unidimensional construct. The literature to date has demonstrated several distinct types of emotion regulation strategies with distinct physiological and behavioral outcomes.

Emotion regulation as a construct has been conceptualized in a number of different ways. One of the better-known models (Gross & John, 2003; John & Gross, 2004) considers emotion regulation to be comprised of two components: *cognitive reappraisal* and *emotional suppression.* Cognitive reappraisal, thought to occur early in the emotional activation process, involves reframing or changing how one thinks about an emotion-prompting situation (specifically with the goal to increase or, more often, decrease an emotional response). Suppression, on the other hand, occurs after emotional activation has occurred. Suppression involves actively inhibiting the internal experience and external expression of emotion, both verbally and by controlling facial expressions to limit emotion conveyed.

Other researchers (e.g., Gratz & Roemer, 2004) have theorized that emotion regulation is multi-dimensional, involving skills for recognizing emotions, as well as a variety of skills for managing emotional reactions. Still others (Hamilton et al., 2009)

have focused on the processes involved in emotion regulation, specifically, the ability to up- and down-regulate emotions as desired.

In a number of mental and physical health domains, researchers have been exploring the applications of mindfulness approaches for emotion regulation (e.g., Carmody, 1989; McCallum, 2010). Recently, Carmody, Vieten, and Astin (2007) highlighted the importance of emotion regulation, and particularly mindfulness and acceptance-based approaches, noting that "mindfulness functions like interoceptive exposure" in the context of negative affect (Carmody et al., 2007, p. 504). Interoceptive refers to sensitization to the internal, usually physiological, sensations that are experienced during negative affect or anxiety. Regulating attention to focus mindfully on current internal experiences in a detached, nonjudgmental way is thus likely to share some of the benefits and challenges of exposure-based therapies (e.g., Orsillo, Roemer, Block-Lerner, LeJeune, & Herbert, 2004). If mindfulness and acceptance-based approaches can offer a framework and enhanced emphasis on developing acceptance and tolerance of initial distress, more people may be able benefit from existing effective treatments with a supplemental mindfulness component.

In summary, these three emotion regulation strategies – suppression, cognitive reappraisal, and mindfulness – have all previously shown associations with affect and behavior. Additionally, there is evidence that individuals differ in their ability and tendency to implement each of these three emotion regulation approaches (e.g., Baer, 2003; John & Gross, 2004). Accordingly, suppression, cognitive reappraisal, and

mindfulness will be the primary emotion regulation strategies examined in the current study.

Effects of Emotion Regulation on Distress and Negative Affect

There is mixed evidence on the relationship between types of emotion regulation strategies and affective outcomes, with most studies showing that suppression is associated with more distress and a few suggesting decreased distress. Other types of self-regulation strategies, such as cognitive reappraisal, appear to improve subsequent behavioral self-regulation outcomes, whereas still others (e.g., mindfulness) have limited evidence to address this question to date.

Distress and emotional suppression. The work of Gross and John (2003; John & Gross, 2004) has demonstrated that, in general, emotional suppression is associated with more distress. Specifically, suppression, avoidance, and judging emotions as "unacceptable" have been associated with higher levels of distress and negative emotions (Campbell-Sills, Barlow, Brown, & Hofman, 2006). In a naturalistic study of emotion regulation, Nezlek and Kuppens (2008) found that suppression was practiced less often than reappraisal, but was associated with more negative outcomes.

Suppression also has been associated with numerous negative physical health outcomes as well as increased immune vulnerability (Salovey, Rothman, Detweiler, & Steward, 2000). For example, in a prospective study of cardiac patients (Denollet, Martens, Nyklícek, Conraads, & de Gelder, 2008) those patients initially presenting with a trait suppression approach reported less distress and anxiety in the short term, but over

the course of a 10-year follow-up, suppressors were at double the risk of cardiac death or myocardial infarction.

The effects of suppression have been studied with regard to chronic pain as well. Chronic pain patients assigned to suppress (versus not suppress) anger during a lab-induced frustration task reported higher levels of pain, and as the authors noted, ironically, higher levels of anger (Burns et al., 2008). These results parallel similar findings from studies of anxiety – specifically, that avoidance of anxiety-provoking stimuli was associated with more distress and greater anxiety symptoms. Across multiple domains, suppression or avoidance-based approaches to coping with emotion or distress are associated with poorer behavioral outcomes and, often, greater emotional distress. In laboratory studies, Gross and colleagues (e.g., Gross & Levenson, 1997) have found that when people are asked to suppress their emotional reactions, they frequently (though not always) report higher levels of distress.

There are also physiological and neuroanatomical correlates of suppression. One study of the physiological effects of suppression as compared to acceptance found that people in the suppression condition reported lower levels of negative affect, but showed a similar level of physiological response (e.g., skin conductance, heart rate; Dunn, Billotti, Murphy, & Dalgleish, 2009). Finally, neuroimaging studies have associated habitual reliance on emotional suppression with specific neuroanatomical structural changes (e.g., increased volume in the anterior insula [Giuliani, Drabant, Bhatnagar, & Gross, 2011] and dorsomedial prefrontal cortex [Kuhn, Gallinat, & Brass, 2011]).

Cognitive reappraisal and distress. Research on mood regulation has demonstrated that absorbing cognitive and behavioral distraction tasks are effective in attenuating both negative and positive mood (Erber & Erber, 2000), providing support for the idea that emotion regulation is not just geared to reducing negative affect, but rather returning to a comfortable equilibrium from either extreme positive or negative affect. A prospective study of college students (Tamir, Srivastava, John, & Gross, 2007) found that individuals who engaged more often in cognitive reappraisal experienced less distress and less depression than did those who more often engaged in suppression. It is worth noting that cognitive and cognitive-behavioral therapies (Beck, 1979; Foa & Kozak, 1986) have one of their bases in the idea that changing appraisal will as a by-product result in decreases in distress, due to changes in evaluation of the target stimulus.

Despite the generally strong association between cognitive reappraisal and diminished later distress, there is some debate as to the efficacy of these approaches. For example, in a recent meta-analysis of different coping strategies, Aldao, Nolen-Hoeksema, and Schweizer (2010) found that cognitive reappraisal and acceptance were only mildly negatively associated with distress or psychopathology. In line with Aldao et al.'s commentary, it is important to expand tests of these hypotheses to new populations or new methodologies to more clearly understand the boundary conditions under which these approaches are and are not helpful.

Mindfulness, acceptance, and distress. Mindfulness, according to Baer (2003, p. 125), is the process of "intentionally bringing one's attention to the internal and external experiences occurring in the present moment." Mindfulness and acceptance-based

therapies are a growing area of psychological interventions for a variety of psychological disorders as well as ancillary treatments for medical conditions. One of the most well-known models of mindfulness meditation adapted for clinical use is the Mindfulness-Based Stress Reduction (MBSR) model (Kabat-Zinn et al., 1992). MBSR has been shown to reduce symptoms of anxiety (Kabat-Zinn et al., 1992) and depression (Teasdale, 1999) in clinical populations.

Another recent model that incorporates mindfulness is Linehan's Dialectical Behavior Therapy (DBT) model. DBT was originally developed to treat individuals engaging in self-harm behaviors. It teaches four types of skills: mindfulness, interpersonal effectiveness, emotion regulation, and distress tolerance. DBT conceptualizes dysregulated behaviors (including self-harm behaviors) as strategies to alleviate perceived intolerable emotional distress (Linehan, 1993). This functional view of dysregulated behavior as attempted emotion regulation led to a focus on teaching skills for distress tolerance (healthy ways of getting through or interrupting immediate, intense emotional distress) and emotion regulation (psychoeducation targeted at improving longer-range identification, acceptance, and functional use of emotions). DBT has demonstrated efficacy in reducing distress, anxiety, and behavioral dysregulation across a number of disorders (Chambless & Ollendick, 2001; Gratz, Tull, & Wagner, 2005), including borderline personality, posttraumatic stress (PTSD), and substance use disorders.

Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999) shifts further from other cognitive models to focus on acceptance of things as they are,

without trying to eliminate the problem. ACT considers the goal of trying to eliminate all distress as problematic, because it is unlikely to occur and thus, like Sisyphus rolling the stone up the hill yet again, engages the individual in a perpetual struggle that cannot be won. ACT focuses on shifting the goals to be more realistic, particularly toward the aim of living life in a values-congruent manner in spite of any pain or distress. As with MBSR and DBT, ACT has demonstrated clinical efficacy in reducing distress and treating anxiety or depression (see Hofmann, Sawyer, Witt, & Oh, 2010 for a review).

Clinical intervention evidence from these models has demonstrated that interventions including a mindfulness component are effective in reducing distress over the course of the therapy. Evidence from a brief lab-based experiment helped shed light on the specific impact of an acceptance-based approach. Using acceptance or reappraisal strategies both prevented the physiological arousal of anxiety (compared to suppression), but acceptance did not prevent the self-perception of increased anxiety or distress (Hofmann, Heering, Sawyer, & Asnaani, 2009). In other words, compared to suppressors, people who use acceptance may perceive the psychological distress of the negative affective experience, but do not experience the same physiological activation.

Is Emotion Regulation Bad for Health Behavior Self-Regulation?

The idea that people use food or other substances with the goal of mood regulation is not new. Researchers across several domains have posited that emotion-regulation impairs behavioral self-control in a logical, if penny-wise, pound-foolish, attempt to alleviate current negative mood, when the urgency of alleviating negative mood trumps longer-range behavioral goals (Tice & Bratslavsky, 2000; Tice et al. 2001).

Resource depletion models (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven, Tice, & Baumeister, 1998) have shown that engaging in one sort of behavioral self-regulation often impairs performance on another self-regulatory task. Baumeister and colleagues (Baumeister, Faber, & Wallace, 1999) have suggested that engaging in coping may function as a resource depleting activity, impairing subsequent self-regulatory behavior. Findings from this literature have been mixed to date.

Motivated use: Eating as an attempt to regulate emotions. An affect regulation model (e.g., Heatherton & Baumeister, 1991) has been applied specifically to bulimia nervosa (BN) and binge eating disorder (BED), theorizing that individuals engage in binge eating to reduce or avoid negative affect. In BED, dysregulated eating appears to be precipitated by an *immediate* [emphasis added] failure in attempts at emotion regulation (Muncsh et al., 2012). One of the key points established in studies of dysregulated eating and negative affect thus far is the immediacy of the link between affective distress and heightened risk for unhealthy behavior. Rather than a slow build-up of stress culminating in a weakening of resolve, studies (e.g., Munsch et al., 2012; Oliver, Wardle, & Gibson, 2000) show a brief spike in stress response and/or negative affect, in some cases combined with impulsivity or deficits in emotion regulation skills, leading to the dysregulated eating behavior, particularly overeating sweet or high-caloric foods. There is also evidence that expectancies that eating will reduce negative affect can play a role in dysregulated eating (e.g., Hohlstein, Smith, & Atlas, 1998; Polivy & Herman, 2002).

Motivated use: Smoking as an attempt to regulate emotions. Several theories of substance use and relapse incorporate motivations to use substances to regulate mood (e.g., Carmody et al., 2007; Kassel et al., 2003; Marlatt & Gordon, 1985; Tiffany, 1990). In the area of smoking cessation, Sjöberg and Johnson (1978) suggested that people who smoke regularly may be using smoking to regulate moods, and that, when they are trying to quit smoking, experiencing stressors can lead to cognitive distortions or errors in cognitive processing. They further stated that, in a state of craving, some cognitive resources are re-directed from the goal of behavioral restraint to processing the craving thoughts. Due to this "mood pressure", higher-level cognitive processing is impaired and likelihood of lapses increases. Sayette (2004) articulated a similar conceptualization, noting that avoidance of unpleasant states is a motivator for addictive behaviors. The belief that smoking will reduce negative affect can promote the use of smoking to cope with negative mood (e.g., Brandon & Baker, 1991). Thus, considering expectancies for mood regulation may be an important component of understanding the role of affect and affect regulation in smoking.

Aim of the Current Research

In summary, there is mixed evidence regarding the effects of emotion regulation on subsequent behavioral self-regulation, though the majority of studies to date suggest that deficits in emotion regulation skills lead to greater impairment in behavioral self-regulation of health behaviors. Further, there is some evidence to suggest that different types of emotion regulation have different effects on affective, behavioral, and health outcomes. The aim of this pair of studies is to advance understanding of the impact of

three different emotion regulation strategies (suppression, mindfulness, and cognitive reappraisal) on two types of health behaviors (eating and smoking). Moderators – particularly habitual emotion regulation styles, expectancies, and negative affect – will also be examined.

Study 1: Effects of Emotion Regulation Strategies on Negative Affect and Eating Behavior

Study 1 tested the experimental effects of three different emotion regulation strategies (and a neutral control condition) on eating behavior and affect, following a brief emotion induction.

Literature Review

Costs of Obesity and Dysregulated Eating Behaviors

Surgeon General Regina Benjamin has stated that the United States is facing an "obesity epidemic", with nearly 35% of adults meeting criteria for obesity (U.S. Department of Health and Human Services [USDHHS], 2010). Overall, obesity and dysregulated eating behavior are significant health, social and economic problems. Obesity has been called the second leading cause of preventable death (Finkelstein, Ruhm, & Kosa, 2005), and although some argue that the health benefits of weight loss are less certain, the benefits of preventing obesity are clear (Kassirer & Angell, 2006). For the individual, obesity is associated with decreased quality of life, poor health, and increased mortality. Obesity and being overweight have been implicated as contributing factors in numerous diseases, including cardiovascular disease, insulin resistance and diabetes, respiratory problems, and numerous cancers (USDHHS, 2010). One group has

calculated that 400,000 deaths per year can be attributed to obesity (Finkelstein et al., 2005).

There are significant economic costs as well, with 5-7% of all medical costs in the U.S. attributed to obesity. This includes longer inpatient hospital stays and nearly 40% more outpatient medical appointments (Finkelstein et al., 2005). Additionally, obesity is associated with absenteeism in the workplace costing $3 billion per year (Finkelstein et al., 2005). Finding ways to improve treatment outcomes to help people lose weight (and maintain weight-loss) is one of the priorities in public health at this time (USDHHS, 2010), but as noted by Kassirer and Angell (1998), prevention of obesity is perhaps even more critical. Identifying psychological and behavioral risk factors for obesity could help to distinguish the potential avenues for intervention, and provide clarity as to who is most likely to be responsive to different approaches.

Behavioral Self-Regulation of Eating Behavior

When medical providers encourage patients to change their eating behavior, historically patients have been provided with standard dietary and exercise advice, perhaps given a referral to a nutritionist, and expected to follow the recommended eating behavior. The underlying assumption of this approach is that it is necessary only to tell people what they need to do to lose weight and they can take it from there. Although the provision of education about health and nutrition can be useful as a starting point, even the great majority of people who know what they are supposed to do fail to act or act consistently on that knowledge. This points to the complexity of behavioral self-regulation and the importance of identifying and implementing additional strategies that

increase the odds of people engaging in health-promoting behavior and decrease the odds of people engaging in health-risk behavior.

Behavioral, cognitive, and community-based approaches. Behavioral techniques for weight loss and healthy eating include regular monitoring of food consumption and exercise, as well as reinforcement for completing desired or undesired behavior. Cognitive behavioral therapy (CBT)- based interventions (e.g., Schlup, Munsch, Meyer, Margraf, & Wilhelm, 2009), which include both behavioral and cognitive reappraisal techniques, are currently one of the few approaches that show empirical support in the treatment of eating disorders (Chambless & Ollendick, 2001; Murphy, Straebler, Cooper, & Fairburn, 2010), but even this success is often limited.

There is a broad range of strategies that have shown promise in augmenting cognitive and behavioral interventions, such as use of implementation intentions (specific how-to plans for that increase the likelihood of enacting a goal behavior (Gollwitzer & Sheeran, 2008; see Rothman, Sheeran, & Wood, 2009 for a review). Additionally, a strong element of community support can be built into behavioral interventions. Group-based treatments, online support communities, and organizations such as Overeaters Anonymous provide social support and a not insignificant amount of accountability. Medical clinics have also found ways to increase accountability through periodic phone calls from nursing staff or, increasingly, automated phone check-ins that allow patients to report and track relevant health data remotely. With behavioral interventions, if people can make the change and keep repeating it, a healthier new habit develops.

Difficulties Sustaining Health Behaviors

Despite the societal focus and variety of multidisciplinary approaches to the treatment of obesity and dysregulated eating, long-term outcomes of interventions for weight loss and treatment of disordered eating often provide limited lasting change. The great majority of people who lose weight while dieting regain the weight once they stop dieting (Kassirer & Angell, 1998). As well, dysregulated or binge eating is quite common among individuals who are overweight or obese, and may contribute to the maintenance of obesity (Bruce & Wilfley, 1996). Thus, efforts to better understand the processes involved in failure to maintain weight loss could provide valuable information for more effective interventions to improve public health.

Barriers to Weight Loss and Maintenance

The abstinence violation effect and the ironic effects of restrained eating. One of the curious aspects of chronic dieting or restrained eating is that it is often associated with weight gain or failure to lose weight (Barnes & Tantleff-Dunn, 2010; Schur, Heckbert, & Goldberg, 2010). However, others have noted that sustained monitoring and restraint of eating behavior are key to weight loss, and argued that associations between binge or dysregulated eating and restraint are, if anything, causal in the opposite direction (i.e., there is an iterative cycle of overindulgence which is then followed by renewed efforts at restraint; Johnson, Pratt, & Wardle, 2012).

Several contributing factors are associated with these counterintuitive outcomes, two of which are the abstinence violation effect (Marlatt & Gordon, 1985) and ironic process theory (Boon et al., 2002; Wegner, 1994; Wenzlaff & Wegner, 2000). The abstinence violation effect (AVE) suggests that breaking a diet leads to feelings of guilt

and shame, which subsequently lead to increased or binge consumption. Ironic process theory (IPT) focuses on the difficulty of effortfully *not* engaging in a task. Application of IPT to restrained eating highlights the challenge of an avoidance-based task such as "not eating candy." Increased focus on "not eating candy" can actually increase the amount of time spent thinking about candy and having to exercise restraint in that endeavor (Adriaanse, van Oosten, de Ridder, de Wit, & Evers, 2011). Therefore, to increase healthy eating behavior, improving restraint alone is unlikely to provide satisfactory results.

Factors Associated with Dysregulated Eating Behavior

Stress and dysregulated eating. Stress has been associated with binge eating, obesity, and dysregulated eating in both clinical (e.g., people with eating disorder diagnoses) and non-clinical populations. During periods of higher stress, people tend to eat fewer typical meals (healthy fruits, vegetables, and meats) and engage in more snacking (Oliver & Wardle, 1999). Work stress and daily hassles have also been associated with increased snacking and increased consumption of fatty or sweet foods, as well as an increase in emotional eating (O'Connor, Jones, Conner, McMillan, & Ferguson, 2008). Overall, people who binge or tend toward emotional eating report higher levels of stress and frustration to daily hassles than those who do not (Conner, Fitter, & Fletcher, 1999; Crowther, Sanftner, Bonifazi, & Shepherd, 2001), and are more stress reactive to controlled stressors (Koo-Loeb, Pederson, & Girdler, 1998), both in self-report and in biological measures (e.g., cortisol).

Moreover, particularly in people who tend toward emotional or binge eating, momentary increases in stress preceded eating higher calorie foods (O'Connor, Jones, Conner, McMillan, & Ferguson, 2008). As well, for obese women who engage in binge eating, stress has been linked to faster eating and decreased perceived satiety (Schulz & Laessle, 2012). Though there is little reason to think stress directly causes clinical levels of disordered eating without prior history of eating disorder, in people with existing eating disorders, stress is associated with exacerbated severity of symptoms. For example, in people with bulimia nervosa, higher stress days have been associated with more binges and purges (Smyth et al., 2007). Similarly, in people with binge eating disorder, higher levels of stress are associated with greater frequency of binges (Gluck, 2006).

Biologically, elevated levels of stress and endocrine hormones (e.g., cortisol, insulin, leptin) have been implicated in weight gain and obesity (Adam & Epel, 2007), particularly with increased abdominal fat (Björntorp, 2001), a significant risk factor for cardiovascular disease that is related to, but distinct from, overall obesity. Endogenous opioids and hypersensitivity of the dopamine reward system are also thought to be associated with emotional and binge eating (Baladi, Daws, & France, 2012; Davis, Levitan, Yilmaz, Kaplan, Carter, & Kennedy, 2012; Mathes, Brownley, Mo, & Bulik, 2009).

In addition, there is evidence of a positive feedback loop between obesity and cortisol levels, such that higher cortisol both contributes to development of obesity and is a product of obesity (Foss & Dyrstad, 2011). Such a mechanism may contribute to

understanding more about the functional barriers to weight loss. Lastly, imaging studies have also shown differences in the serotonin regulatory system in individuals with AN or BN (Kaye et al., 2005). Taken together, these findings suggest biological systemic factors are involved in the maintenance if not the etiology of disordered and dysregulated eating behavior.

The cultural stereotype of "stress eating" (the tendency to overconsume unhealthy foods when stressed) is borne out in the evidence: In longitudinal and epidemiological studies of nonclinical populations, stress – including chronic stress – is consistently associated with obesity as well as poorer dietary choices (Torres & Nowson, 2007). There is debate as to the mechanism of this association, with evolutionary (Siervo, Wells, & Cizza, 2009), biochemical (Adam & Epel, 2007), and sociocultural-environmental (Crowther et al., 2001; Siervo et al., 2009) explanations all contributing rationales for the link. Regardless of causal mechanism(s), the base of evidence consistently links stress with poorer eating behavior and higher rates of overweight and obesity.

Negative affect and emotional eating. Negative affect and difficulties with emotion regulation have often been associated with disordered eating behavior, particularly binge eating and binge eating disorder (BED), but also bulimia nervosa (BN) and anorexia nervosa (AN) (e.g., Harrison, Genders, Davies, Treasure, & Tchanturia, 2010; Hilbert & Tuschen-Caffier, 2007). Depressed mood, particularly in conjunction with emotional eating, has been associated with poorer dietary habits (i.e., eating more sweets, eating more food overall; Kontinnen, Männistö, Sarlio-Lähteenkorva,

Silventoinen, & Haukkala, 2010), though other studies have found no direct relation

between negative affect and emotional eating (see Spoor, Bekker, van Strien, & van

Heck, 2007).

Negative affect has been identified as both a trigger and a consequence of

disordered eating. For example, in two samples (women with BN and BED), negative

mood was elevated prior to binge episodes, and even higher post-binge (Hilbert &

Tuschen-Caffier, 2007). One of the areas that has been the subject of considerable focus

in recent years is the role of emotional eating in promoting bingeing and BED.

Accordingly, the majority of the studies to date that examine the effects of emotion

regulation strategies and eating behavior focus on interventions for clinical populations

(e.g., BED; Clyne, Latner, Gleaves, & Blampied, 2010; Safer, Robinson, & Jo, 2010).

Though the majority of studies to date that investigated negative affect and eating

disordered populations have focused on BN and BED, emotion regulation has also been

associated with AN. For example, an experimental induction of frustration produced

more aggression and fewer solution-focused responses in women with anorexia nervosa

(Harrison et al., 2010). Though the great majority of research on affect or emotion

regulation and eating behavior focuses on women, the findings appear to apply to men as

well; men who had difficulty regulating emotions reported more disordered eating and

body dissatisfaction (Lavender & Anderson, 2010).

Overall, there is consensus that impaired emotion regulation is associated with

difficulties in regulating eating behavior (particularly in eating disorders such as BED

and BN). Stress and negative affect have been associated with poorer self-regulation of

eating behavior in nonclinical samples, particularly for people who believe that eating will improve their mood (Tice, Bratslavsky, & Baumeister, 2001) and with increases in emotional eating (O'Connor et al., 2008). Similarly, a combination of lack of perceived self-regulatory skill and a tendency toward emotional eating was associated with poor eating behavior (Sproesser, Strohbach, Schupp, & Renner, 2011). Problems with emotion regulation have also been linked to emotional eating (Vohs & Heatherton, 2000; Evers, Stok, & de Ridder, 2010) and associated with greater risk of obesity in non-clinical samples (O'Connor et al., 2008).

Effects of Emotion Regulation on Eating Behavior

In the previous literature, some studies show that at least one type of emotion regulation, suppression, is associated with poorer behavioral self-regulation. Others suggest that different types of self-regulation appear to improve subsequent behavioral self-regulation outcomes.

Eating and emotional suppression. There are few lab-based controlled studies of the effects of emotional suppression on eating behavior. Vohs and Heatherton (2000) had participants watch a stimulus video clip designed to induce negative affect. They asked one group to suppress their emotional reactions to the clip and found that, relative to controls, after suppressing their emotional reactions to the video clip, participants ate significantly more ice cream, indicating that suppression is associated with decreased subsequent behavioral restraint. Evers et al. (2010) used similar emotion-induction procedures, but investigated the effects of habitual or trait emotion regulation styles (high or low suppression, and high or low cognitive reappraisal, on the Emotion Regulation

Questionnaire [ERQ; Gross & John, 2003]) on food consumption. Suppression moderated the relation between sad mood (induced by recall of a sad personal event) and food intake, such that high suppression individuals consumed significantly more than individuals who do not frequently use suppression. A study of chocolate consumption combined diary record and observed lab eating behavior found that suppression was equally effective as acceptance in limiting reported chocolate consumption over the week (Hooper et al., 2012); however, those in the suppression condition showed a rebound effect, consuming significantly more chocolate during the follow-up lab session.

In contrast, findings from a lab-based experimental study with a clinical sample (participants with BED) found no support for the hypothesis that suppression leads to increased eating (Dingemans, Martijn, Jansen, & van Furth (2009). Rather, they found that depressed mood and negative affect were directly and positively associated with consumption; being asked to suppress emotions while watching a brief film clip had no impact on immediate food consumption for this clinical population. Dingemans et al. suggested that these findings indicate that participants may have been using eating to regulate mood; this interpretation is consistent with the models of Tice (Tice et al., 2001; Tice & Bratslavsky, 2000) and others who suggest that short-term strategies for mood repair can circumvent behavioral health maintenance behaviors. Owing to the mixed findings from these studies, the current study will measure habitual or trait emotion-regulation style and will also manipulate emotion regulation in response to a negative affect inducing stimulus.

Cognitive reappraisal and eating. Only two lab-based studies were identified that tested the impact of cognitive reappraisal instructions on eating behavior following a negative mood induction. The first study (Evers, Stok, & de Ridder, 2010) found that in the absence of emotion regulation instruction, individual differences in trait frequency of cognitive reappraisal were not associated with any difference in consumption of snack foods. In two additional experiments (Evers et al., 2010), negative mood was induced by viewing a violent video clip, and emotion regulation strategy was manipulated (e.g, by instructing participants to remind themselves that paid actors were acting out a scene that was not real for the reappraisal condition). In both experimental studies, participants assigned to the reappraisal condition consumed significantly less "comfort foods" (sweet or salty foods), but not less of other available food.

The second study (Taut, Renner, & Baban, 2012) examined the effects of suppression, cognitive reappraisal, and a neutral control condition on whether participants chose to eat chips or chocolate, and if so, how much they consumed. The majority of participants in the reappraisal condition chose not to eat either chips or chocolate, in contrast to other groups. However, among participants who ate, there was no difference in the amount consumed across conditions. In contrast to results from correlational studies with clinical populations (e.g., Hilbert & Tuschen-Caffier, 2007), participants' reported negative affect did not predict eating behavior in either study (Evers et al., 2010; Taut et al., 2012).

Mindfulness, acceptance, and eating. Though few experimental lab-based studies of mindfulness or acceptance and eating behaviors exist, there are several

experimental field studies applying mindfulness or acceptance based approaches to interventions with clinical populations (e.g., women with BED). Early efforts to adapt Dialectical Behavior Therapy (DBT; Linehan, 1993), which emphasizes psychoeducation and skills for emotion regulation for BED, suggest that emotion regulation interventions may improve outcomes for individuals with BED (e.g., Telch, 1997; Telch, Agras, & Linehan, 2001; Safer et al., 2010). Other group therapy interventions providing psychoeducation about emotions and skills for emotion regulation have also had positive effects on BED symptoms (Clyne & Blampied, 2004; Clyne et al., 2010).

Interventions adapting mindfulness meditation (inspired by MBSR and the related Mindfulness-Based Cognitive Therapy [MBCT]) to treatment for BED also demonstrated significant improvement in symptoms (e.g., reduced frequency and severity of binges; Baer, Fischer, & Huss, 2006; Kristeller & Hallett, 1999), with similar results in a small study of mindfulness-based treatment for BN (e.g., Proulx, 2012). In contrast, others (Kelly, Lydecker, & Mazzeo, 2012) have found that both acceptance and suppression were positively associated with binge eating, though cognitive strategies including reappraisal were associated with decreased binge frequency.

Limitations of the Previous Literature

The current study focused primarily on further differentiating the effects of several types of emotion regulation strategies in relation to regulating eating behavior, and contributes to the literature in this area in several key ways. First, few controlled, lab-based studies have experimentally examined the impact of different emotion-regulation strategies on eating behavior. Studies that have examined emotion regulation have

typically focused on just one emotion regulation approach. For example, Vohs and Heatherton (2000) reported on the detrimental effects of suppression on ability to regulate eating. Only two studies experimentally compared the impact of different emotion regulation strategies on eating in a non-clinical sample (again, comparing suppression vs. reappraisal; Evers et al., 2010; Taut et al., 2012).

Secondly, some existing studies that have examined stress management or mindfulness-based emotion regulation approaches for eating have done so in clinical interventions, which by design inherently provide more external validity for clinical use, but less experimental control and internal validity for testing causal relations, compared to brief lab-based manipulations. For example, to date, the main studies of mindfulness interventions for eating (e.g., Clyne et al., 2010) have been conducted in a group format over extended periods of time; in studies of this design, attrition, compliance, and adherence to protocols reduce internal validity.

Lastly, though mindfulness and acceptance-based strategies for emotion regulation have been theoretically linked to improvements in self-regulation of health behaviors (Carmody et al., 2007; Wisniewski, Safer, & Chen, 2007), few studies have empirically addressed this relation. Of these, a handful of studies have tested mindfulness- and acceptance-based clinical intervention approaches for emotion regulation in eating disordered populations (e.g., Clyne et al., 2010; Telch et al., 2001). However, the component aspects of mindfulness have not been experimentally studied compared to other strategies for emotion regulation with regard to impact on eating behavior in non-clinical samples. To my knowledge, there are as yet no laboratory studies

of the effects of mindfulness or acceptance-based emotion-regulation techniques on eating behavior.

Purpose of the Study

In summary, the primary purpose of the current study is to address the question of how different types of emotion regulation impact subsequent behavioral self-regulation. The current study compared the effects of three different emotion regulation strategies (suppression, cognitive reappraisal, and mindful acceptance) and a no-instruction control group in a controlled laboratory environment on food consumption in a nonclinical sample. The study aimed to further address the question of whether (or what sort of) emotion regulation impairs or facilitates behavioral self-regulation, as well as any effects of various emotion regulation strategies on distress or negative affect.

Potential covariates and moderators. Because stress, anxiety, and depression are associated with more emotional eating, and may also be associated with difficulty in regulating emotion, baseline levels of perceived stress, anxiety, and depression were assessed in all participants to verify equal distribution across experimental conditions. Participants also completed several emotion or mood regulation scales to more fully capture pre-existing individual differences in ability, beliefs, and strategies for regulating moods. Including multiple measures purporting to measure different aspects of emotion regulation allowed for better assessment of the participants' individual differences in the various emotion regulation constructs.

Additionally, participants completed measures of eating behavior (including restrained and emotional eating) and expectancies for eating (including reduction of

negative affect). Inclusion of these measures allowed for testing moderation hypotheses about the role of habitual emotion regulation styles, emotional eating, and negative affect reduction expectancies.

Hypotheses

  Hypothesis 1. Different types of emotion regulation will be differentially related to negative affect and distress following the film. Emotion regulation condition, the independent variable (IV), was predicted to be associated with different levels of negative affect and distress following exposure to the emotion induction stimulus. Planned contrasts tested for differences between 1) Suppression versus Mindfulness and Cognitive Reappraisal, 2) Suppression and Control versus Mindfulness and Reappraisal, 3) Suppression versus Control, and 4) Mindfulness versus Cognitive Reappraisal.

  Hypothesis 2. Different types of emotion regulation will be differentially related to eating behavior post- emotion-induction. I predicted that emotion regulation condition would be associated with amount of each of the three snack foods consumed post- emotion-induction. Specifically, I predicted that participants in the Suppression condition would eat more food than those in the Mindfulness and Cognitive Reappraisal conditions, as well as the Control condition. No difference in amount consumed was expected between those in the Mindfulness condition compared to the Reappraisal condition.

  Hypothesis 3. Post- emotion-induction distress and negative affect will not independently predict eating behavior. Based on previous research, distress and

negative affect alone were not expected to predict eating behavior, as measured by the amount consumed following emotion induction.

Hypothesis 4. Trait emotion regulation will moderate the relation between emotion regulation condition and eating behavior post- emotion-induction. I predicted an interaction between trait emotion regulation and emotion regulation condition in amount of snack food consumed. Based on previous research, people higher in trait emotion suppression (as measured by the ERQ suppression subscale), and in difficulty regulating negative emotion (as measured by higher scores on the DERS) and people lower in expectancies for regulating negative mood (as measured by lower scores on the NMR) were expected to eat more snack foods following the emotion-induction, particularly if they were also in the suppression condition.

Hypothesis 5. Eating expectancies for mood regulation will moderate the relation between emotion regulation condition and eating behavior post- emotion-induction. I predicted that for people in the Suppression condition, those also high in eating expectancies (EEI-NA) or emotional eating (DEBQ-EE) would consume more snack foods.

Hypothesis 6. Post- emotion-induction negative affect and distress will moderate the relation between emotion regulation condition and eating behavior post-emotion-induction. I predicted that for people in the Suppression condition, those who also reported higher levels of distress or negative affect would consume more snack foods.

Method

Participants

An a priori power analysis was conducted using G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) to determine sample size necessary to have 0.95 power to detect a small effect size ($f^2 = 0.10$) for the MANOVA main effects and interactions. This resulted in the determination that at least 108 participants (27 per each of the four experimental conditions) would be required for this study.[1]

Participants ($N = 114$) were recruited from students in undergraduate psychology courses at a large Midwestern university. The majority (64%) identified as female, 34.4% identified as male and 1.8% did not disclose gender. In terms of ethnic identification, most participants (59.3%) identified themselves as European American, with other participants identifying as African/African American/Black (9.7%), Asian/Asian American (24.8%), Hispanic/Latino(a)/Mexican American (1.8%), Native American (.9%), and Bi/Multi-Racial (2.7%). One participant (.9%) endorsed "Other", specifying Middle Eastern descent.

The great majority of participants (77.9%) were between 18-21 years of age, with 17.7% between ages 22-25, 2.7% between ages 26-29, and the remaining 1.8% over age 30. Participants were also asked to report their year in school, with the results as follows: 32.1% Freshmen, 20.5% Sophomores, 24.1% Juniors, 19.6% Seniors, and 3.6% endorsing "Other". All participants received extra course credit for their participation in the study.

---

[1] Originally, the intent was to use two sets of MANOVA (one set for distress and negative affect outcomes, and one set for the three food outcomes). However, because the three foods were not all correlated and other studies found different patterns of results for different foods, the decision was made to use ANOVA to examine the three food outcomes separately. This decision resulted in lower power to detect effects, as ANOVA requires more observations per cell to detect an effect.

Measures

Measurements were collected at two time points: the first baseline assessment via a secure online questionnaire, and the second set of measures during an individually scheduled lab session. Participants also completed a food log prior to attending the scheduled lab session.

Baseline measures.

All participants completed basic demographic information (age, gender, ethnicity, year in school), as well as all of the following initial assessments online, prior to the lab session. See Table 1 for timeline of all measures.

Measure of positive and negative affect.

Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS was used to measure both positive (PA) and negative affect (NA). Participants were asked to respond to 20 words (e.g., *enthusiastic*, *distressed*) on a 5-point scale ranging from *very slightly or not at all* (1) to *extremely* (5). Scores on the PANAS have been validated for use as both a trait and state measure, when used with a variety of different time frame prompts, and both the PA and NA scales have shown internal consistency reliability in other samples (α's ranging from .84 to .90; Watson et al., 1988). During the initial online assessment (T1), participants were asked to complete this measure with the prompt *in general* (i.e., to what extent do you generally feel this way, on average), and later at T2 with the prompt *today* (i.e., to what extent have you felt this way today), yielding a trait and a state measure of positive and negative affectivity,

respectively. Internal consistency reliabilities in this sample for scores on NA and PA scales at both baseline and the lab session ranged from α = .80 to .91.

   Measures of stress, anxiety, and depression.

   Perceived Stress Scale. Participants completed the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). The 14-item PSS asks participants to report the frequency of different feelings, thoughts, or reactions in the past month, on a 5-point scale from *never* (0) to *very often* (4). For example, one item asks "*In the past month, how often have you felt that you were unable to control the important things in your life?*" Scores on the PSS have shown internal consistency reliability in other samples (α = .84 - .86) and demonstrated validity in other studies (e.g., Cohen et al., 1983). Internal consistency reliability for the PSS in this sample was α = .85.

   Depression Anxiety Stress Scale (DASS). Participants completed the Depression Anxiety Stress Scale-21 (DASS; Lovibond & Lovibond, 1995), a 21-item measure with seven items on each of three subscales (depression, anxiety, and stress). Participants were asked to respond to items such as *I tend to over-react to many situations,* and *I found it difficult to work up the initiative to do things*, on a 4-point scale ranging from *Did not apply to me at all* (0) to *Applied to me very much, or most of the time* (3) with regard to the past two weeks. Scores on the DASS Depression, Anxiety, and Stress scales have shown internal consistency reliability in other samples (α's ranging from .84 to .90; Crawford & Henry, 2003). In the current study internal consistency reliability was α = .94 for the full scale; reliabilities were .89, .77, and .80 respectively for each of the three subscales (DASS-D, DASS-A, DASS-S).

Measures of emotion regulation.

Emotion Regulation Questionnaire (ERQ). The 10-item ERQ (Gross & John, 2003) assesses individual differences in habitual use of two of the most common types of emotion regulation strategies studied: cognitive reappraisal and suppression. Reappraisal is measured with items such as *When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm.* Items measuring suppression include *I control my emotions by not expressing them.* Participants responded to items on 7-point scale, from *strong disagreement* (1) to *strong agreement* (7). Scores on the ERQ are well-validated, and in other samples (e.g., Gross & John, 2003; Moore, Zoellner, & Mollenholt, 2008), scores on the ERQ have shown internal consistency reliability, with α ranging from .79 to .86 for Cognitive Reappraisal (ERQ-CR) and .73 to .83 for Suppression (ERQ-S). In this sample, both the ERQ-S ($\alpha = .80$) and ERQ-CR ($\alpha = .85$) showed internal consistency reliability.

Difficulties in Emotion Regulation Scale (DERS). The DERS (Gratz & Roemer, 2004) is a multidimensional measure of emotion regulation, including six empirically validated factors: nonacceptance of emotional reactions, difficulty engaging in goals, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. The measure consists of 36 items which participants responded to on a 5-point scale from *almost never* (1) to *almost always* (5). In other samples, scores on the scale have demonstrated validity and reliability (e.g., total scale $\alpha > .90$, subscale α's all $> .80$; Gratz & Roemer, 2004). In the

current study, the DERS reliability for the total scale was α = .94, with subscale α's all > .86.

Negative Mood Regulation (NMR). The NMR (Catanzaro & Mearns, 1990; 1999) is a 30-item inventory focused only on regulation of negative, but not positive, moods. The NMR assesses individual differences in expectancies about personal ability to regulate negative moods. Participants were asked to respond to items such as *I can usually find a way to cheer myself up* and *I won't be able to put it out of my mind* (reverse-scored), on a 5-point scale from *strong disagreement* (1) to *strong agreement* (5). The NMR has been well-validated and in other samples, scores on the NMR have shown internal consistency reliability (α's > .90; Catanzaro & Mearns, 1990). In the current study, the reliability for the NMR scores was α= .92.

The Emotion Amplification and Reduction Scales (TEARS). The TEARS (Hamilton, Karoly, Gallagher, Stevens, Karlson, & McCurdy, 2009) is a relatively new 18-item measure that assesses beliefs about personal ability to regulate emotion in two distinct ways: emotion amplification (e.g., *If I want to, I can get myself emotionally "charged up"*) and emotion reduction (e.g., *No matter how intensely I may be feeling a particular emotion, I can almost always make myself calm down).* Participants responded to these items on a 4-point scale from *not at all true for me* (1) to *very true for me* (4). Hamilton and colleagues developed the TEARS to focus specifically on the process goals of emotion regulation, distinct from the end-states of emotion regulation or dysregulation. In other samples, scores on the TEARS have shown internal consistency reliability (α's between .87 - .89; Hamilton et al., 2009). In the current study, reliabilities for the

Amplification (TEARS-A) and Reduction (TEARS-R) subscales were α = .92 and α = .93, respectively.

Mindfulness. The Mindful Attention and Awareness Scale (MAAS; Brown & Ryan, 2003) was used to measure mindfulness. Participants were asked to respond to the 15-item measure on a 6-point scale from *almost always* (1) to *almost never* (6). For example, one item reads *I find it difficult to stay focused on what's happening in the present*. MAAS has been well-validated as a measure of mindfulness and awareness, and scores on this scale have shown internal consistency reliability in other studies (α's ranging from .80 to .87; Brown & Ryan, 2003). In the current study, the reliability for the MAAS was α = .91.

Measures of eating behavior and eating expectancies.

Dutch Eating Behavior Questionnaire (DEBQ). The DEBQ (van Strien et al., 1986) is a 33-item measure that assesses three types of eating behavior (restrained eating, external eating, and emotional eating) on a 5-point scale ranging from *never* (1) to *very often* (5). Scores have been shown to have good reliability (all subscales' internal consistency reliability α > .80) and validity in multiple samples (van Strien et al., 1986; Wardle, 1987). In the current study, for all three subscales, reliability was good (α's ranging from .84 to .96).

Eating Expectancy Inventory (EEI). The EEI (Hohlstein et al., 1998) is a 34-item scale with five subscales measuring learned expectancies for reinforcement from eating (i.e., managing negative affect, leads to feeling out of control, alleviating boredom, eating is pleasurable and useful, and eating enhances cognitive competence). Participants were

asked to respond to the items on a 7-point scale ranging from *strongly disagree* (1) to *strongly agree* (7). In previous studies, scores on the EEI have shown internal consistency reliability (α's > .90) and validity (Hohlstein et al., 1998; Collins & Ricciardelli, 2005). In the current study, most subscales showed good internal consistency reliability (α's ranging from .81 to .93), with one subscale showing acceptable reliability (α = .76).

Lab Session Measures

Pre-lab session measures.

Prior to attending the scheduled lab appointment, participants were asked to track their food consumption for the previous 24 hours on a food log that was emailed to them in advance. The primary purpose of this was to gain an additional report of the recency of last meal, with potential for use in additional analyses not included in the present study.

Pre-emotion induction measures.

At the start of the lab session, the consent form (previously signed online) was reviewed and participants were provided a copy. Participants were asked to report the time since last meal or snack was consumed. The researcher checked to ensure that the time elapsed was at least two hours.

Distress. Before receiving the emotion regulation instructions, participants completed a Subjective Units of Distress (SUDS) rating of current distress, on a scale from *no distress at all* (0) to *the most distress you have ever experienced* (100).

Emotion regulation instructions.

Participants were randomly assigned to one of four conditions: Suppression, Cognitive Reappraisal, Mindfulness, or a no-instruction Control condition. Each condition was provided with emotion regulation instructions to follow during the emotion induction procedure. Participants in the Suppression condition were instructed to suppress any emotions or expressions of emotion, participants in the Cognitive Reappraisal condition were instructed to remind themselves that it was a fictional movie if they experienced any emotions, and participants in the Mindfulness condition were instructed to just notice and accept any emotions they experienced. In addition, participants in the Control (C) condition viewed the emotion induction stimulus with only the instruction to watch the following clip (see Appendix A for text of emotion regulation instructions).

Emotion induction stimulus.

The emotion induction procedure followed that of Gross and colleagues (e.g., Gross & Levenson, 1997; Rottenberg, Ray, & Gross, 2007), using a brief digital clip, excerpted from the movie *Return to Me* (Tugend & Hunt, 2000); please see the Pilot Study in Appendix B for additional details on the content, selection, and validation of this excerpt. The stimulus clip was designed to invoke a moderately intense emotional reaction of negative affect, specifically sadness, as it consistently has been shown to elicit the desired affective response. The same movie clip was used as an emotion induction stimulus for all participants. However, as described above, participants assigned to different conditions were given different instructions for emotion regulation to follow while watching the clip.

Post-emotion induction outcome measures.

Distress and affect. Immediately after completing the emotion induction, participants again completed a SUDS rating of current distress, on a scale from *no distress at all* (0) to *the most distress you have ever experienced* (100). Participants also completed the PANAS (Watson et al., 1988; described more fully above in online measures), this time with regard to current state. Both the PA ($\alpha = .82$) and NA ($\alpha = .80$) subscales of the PANAS showed good reliability in this sample at this time point.

Food preferences task. Participants were told that the study was interested in the effects of thoughts and emotions on food preferences. Accordingly, a 'food preferences' task was presented following the emotion induction and distress measures. In this food preferences task, participants were asked to complete ratings of three different snack foods. Before beginning the tasting portion of the activity, the three bowls of snack foods (bland crackers, potato chips, and M&Ms) were placed in front of the participants, who rated how appealing each food looked and how much they wanted to eat the food. Next, as they tasted each food, participants rated how much they enjoyed eating the food as well as various descriptive qualities (e.g., sweet, bitter, sour, salty, and bland). All ratings were completed on a 7-point scale ranging from *not at all* (1) to *extremely* (7).

The true outcome of interest, however, was the amount of each food consumed during the task ostensibly focused on taste preferences. Participants were told they were welcome to eat as much as they liked of each food, but to try at least a little bit of each one so they could provide ratings for each food. To reduce interference from bystander observation, participants completed the lab session individually in separate rooms, and

the researcher was not in the room during the 10 minutes participants were given to complete the food preferences task (T. Mann, personal communication, April 7, 2011). As in similar lab-based studies of eating behavior (e.g., Vohs & Heatherton, 2000), each snack was laid out in large bowls that appeared to hide the amount consumed; however, each bowl of snacks was weighed pre- and post-session, so the amount consumed (weight in grams) could be measured. Digital scales accurate to .1 grams were used, and care was taken to ensure accuracy of measurement by standardizing the procedure for zeroing scales before each use. Additionally, care was taken that for each individual, pre- and post-weight measurements were taken using the same scale.

Manipulation check. After completing other outcome measures, participants were asked to respond to the prompt *Please describe everything that was going through your mind while you were watching the movie clip. Please be specific.* Participants were also asked to report the extent to which they used each of the three emotion regulation styles (suppression, cognitive reappraisal, and mindfulness). Responses to all these questions were on a 7-point scale from *not at all* (1) to *extremely* (7).

Procedure

Recruitment. Participants were recruited from undergraduate psychology courses. Interested participants emailed the researcher to sign up. Potential participants were told the study was about how emotions affect how people think and their food preferences. Eligibility criteria included being 18 years of age or older, enrolled in a participating undergraduate psychology course, and having no food allergies (due to the nature of the food preferences task). A link to a secure online survey with a randomly

assigned unique password was sent to interested participants ($N = 152$) meeting the eligibility criteria (all but one individual – who was under age 18 – met criteria for participation). A number of participants who were emailed the link failed to start ($n = 17$) or started but failed to complete ($n = 2$) the online T1 survey.

Time 1 overview and participant flow. Participants reviewed the consent form as the first page of the online questionnaire, and were encouraged to contact the researcher by phone or email with any questions before proceeding; those who did not provide their electronic signature by checking the box consenting to participate ($n = 2$) did not proceed to the online questionnaire and were not enrolled in the study. Thus, a total of $n = 131$ participants completed the initial online questionnaire and were enrolled in the study (see Figure 1 for a flow chart of Study 1 participant attrition and completion). All baseline (T1) assessment measures were completed via this secure online questionnaire. In this initial assessment, participants were asked to report demographic variables, several measures of emotion regulation, perceived stress, distress, positive and negative affect, mindfulness and two eating-related measures (eating behavior and eating expectancies).

Time 2 overview and participant flow. To reduce priming effects from the baseline questionnaires, participants were asked to come into the lab individually for the 45-minute lab session a few days after completing the initial online assessments. The majority (89%) of the $n = 132$ participants who completed the T1 measure also completed the T2 lab session (see Figure 1). At the lab session, participants ($n = 117$) were welcomed and provided a paper copy of the same consent form they had already

electronically signed at the start of the online baseline questionnaire. Participants were invited to ask any remaining questions about the study prior to proceeding. The researcher collected the food log while participants completed a brief screening about food allergies, recency and content of last meal, current hunger, and current distress. The researcher then reviewed the screening questions and food log to verify no reported food allergies and last food eaten at least two hours prior. In cases where participants had eaten within the past two hours ($n = 3$), the lab session was briefly postponed until the two hours had elapsed ($n = 2$) or was rescheduled for another day ($n = 1$). See Table 1 for summary of measures used at each time point.

Prior to the negative mood induction, participants were given instructions corresponding to the emotion regulation condition (Suppression, Control, Mindfulness, Cognitive Reappraisal) to which they had been randomly assigned. Participants watched a brief digital clip from a movie that had previously been demonstrated to induce negative affect. Following the emotion induction, current distress and affect were measured. Next, participants were asked to complete a food preference rating activity. Finally, participants completed a brief manipulation check for the emotion induction.

Results

Data Cleaning

Outcome variables. As advocated by Tabachnick and Fidell (2007), I analyzed for univariate outliers in the food consumption outcomes separately within each condition. A total of four outliers were identified: one in the Suppression condition for Food A – Crackers, one in the Suppression condition for Food B – Chips, one in the

Suppression condition for Food C – M&Ms, and one in the Mindfulness condition for Food C – M&Ms, when using a criterion of z-scores greater than 3.29 considered outliers. Review of original lab documentation revealed no errors in data entry or computation. Because the outlying values were conceivable real values that could be part of the population in question, in accordance with guidelines from Tabachnick and Fidell (2007) the decision was made to winsorize the outliers rather than trimming, in order to normalize the distribution to reduce skew, while retaining as much meaningful data as possible. No univariate outliers were identified for either distress or negative affect; skew was also within normal limits (i.e., within the range of +/- 1).

I used regression to calculate Mahalanobis distance, a measure of multivariate outliers to identify any multivariate outliers among the five outcome variables (three snack food outcomes, distress, and negative affect). Following the recommended procedure, the analysis was conducted separately for each condition. Mahalanobis distance is interpreted using a χ^2 distribution at $p < .001$, with degrees of freedom equal to the number of variables (Tabachnick & Fidell, 2007). In this case, using $\chi^2 (5) = 20.515$, $p < .001$ as the criterion, there were no multivariate outliers within any of the four emotion regulation conditions.

Demographic and psychosocial variables. All baseline scales (PANAS, PSS, DASS, MAAS, DEBQ, EEI, ERQ, NMR, DERS, TEARS) were not significantly skewed (i.e., skew within +/- 1). Prior to conducting planned analyses, I tested for differences in demographic variables (gender, age, race/ethnic identification, year in school) across conditions, as well as associations between demographic variables and outcome variables

(distress, negative affect, and amount eaten of each of the three snack foods: bland crackers, potato chips, and M&Ms). There were no significant differences in any of the demographic variables across conditions. Additionally, there were no significant differences in race/ethnic identification or year in school for any of the food or distress/negative affect outcomes. There was a significant difference in amount of Food B – Chips consumed (but not either of the other food outcomes) across gender, $t(61.84) =$ 1.97, $p = .05$, such that men ate more chips than did women overall. There was also a significant difference across gender for distress (but not negative affect), $t(108) = -2.28$, $p < .05$, such that women reported more distress overall than did men.

Significant differences for age were identified in the amount of Food A – Crackers consumed, $t(82.25) = 2.07$, $p < .05$, and in the amount of Food B – Chips consumed, $t(56.92) = 2.65$, $p < .05$, such that individuals 18-21 ate significantly more crackers and chips (but not Food C – M&Ms) than did participants 22 and older. There was no significant difference for age in terms of distress or negative affect.

I also conducted correlations between all baseline psychosocial and eating-related measures (PSS, DASS, PANAS, DEBQ, and EEI) and outcome variables (distress, NA, and amount of each food eaten). Correlations between baseline psychosocial measures and both food and distress outcome variables were assessed to identify whether any baseline measures needed to be included as covariates in the planned analyses. Measures of stress, anxiety and depression showed either no correlation or small correlation with each of the three food outcomes (all r's < .22); see Table 2 for details. Baseline measures of positive and negative affect were uncorrelated with food outcomes (all r's < .10).

Measures of eating behavior and eating expectancies were uncorrelated with food outcomes (all r's < .20). In addition, trait or habitual emotion regulation styles were assessed at baseline and correlates with food outcomes (see Table 3). All measures of habitual styles of emotion regulation (ERQ, NMR, DERS, TEARS, and MAAS) and their subscales were uncorrelated or had low correlations with the three food outcome measures (all r's < .20).

As might be expected, several baseline affective and emotion regulation measures showed small to moderate correlations with the distress and negative affect outcome measures (r's ranged between .01 and .46; see Tables 2 and 3). However, unless the groups differed in baseline level of the affective or emotion regulation variables, random assignment to condition should ensure that condition is the primary factor affecting outcomes. Therefore, I examined mean differences in all baseline measures across conditions to identify any pre-existing group differences despite random assignment to condition. No significant differences were found across conditions, though two variables (positive affect [between suppression and cognitive reappraisal] and NMR [between suppression and control]) showed a marginally significant difference across conditions (see Table 4).

Manipulation check. Though the emotion regulation instructions were validated in the Pilot Study (see Appendix B), manipulation check questions were also included in this study. However, results of the Study 1 manipulation check questions were expected to be less accurate, because here in Study 1, other outcome measures (e.g., distress, negative affect, food tasting preferences task) were completed between the emotion

induction task and manipulation check questions. Separate ANOVAs with one planned contrast were conducted for each of the three manipulation check questions. Results showed that participants in the Suppression condition reported using the suppression strategy significantly more than members of the other three groups, and participants in the Mindfulness condition reported using the mindfulness strategy marginally more than participants in the other three conditions.

In contrast, participants in the Cognitive Reappraisal condition did not significantly differ from the other three conditions in reported use of the reappraisal strategy. This finding differs from the results of the Pilot Study conducted in the same population, which showed that participants instructed to use Cognitive Reappraisal reported doing so significantly more than participants in the other groups (see Table 5 for more detailed comparison). As noted above, the intervening activities (distress, negative affect, and food outcome measures) in Study 1 provide one likely explanation for this discrepancy, and suggest that between the two, the manipulation check data from the Pilot Study may be more informative.

Differences in Distress and Negative Affect by ER Condition

Hypothesis 1. Different types of emotion regulation will be differentially related to negative affect and distress. Emotion regulation condition, the independent variable (IV), was predicted to be associated with different levels of negative affect and distress following exposure to the emotion induction stimulus. Negative affect was measured by post-emotion-induction PANAS scores, and distress was measured by post-emotion-induction SUDS ratings of distress. Specifically, I predicted that people in the

Cognitive Reappraisal and Mindfulness conditions would report similar levels of negative affect and distress, and both Cognitive Reappraisal and Mindfulness groups would report less distress and negative affect than the Control condition. Previous literature is mixed with regard to suppression and distress, with suppression more often associated with higher levels of distress and negative affect, but sometimes associated with minimal distress or negative affect. Thus, I expected that people in the Suppression condition would report more distress and negative affect than those in the Mindfulness and Cognitive Reappraisal conditions, but the difference might be small or not significant. No specific prediction was made regarding relative levels of distress and negative affect for those in the Suppression condition compared to the Control condition, though it was expected that if there was a difference between the groups, participants in the Suppression condition would report more distress and negative affect than those in the Control condition. Finally, because there is theoretical debate as to whether Mindfulness is equally effective in preventing distress compared to Cognitive Reappraisal, I also tested whether there were significant differences in distress and negative affect between these two conditions.

These hypotheses were tested using a multivariate analysis (MANOVA), as the two outcome measures, negative affect and distress, were significantly correlated, $r(110) = .47, p < .001)$. The overall multivariate effect for condition was not significant, Wilks' Lambda = .93, $F(6, 210) = 1.33, p = .25, ns, \eta_p^2 = .036$. Looking separately at the univariate effects, condition was marginally associated with negative affect, $F(3, 106) = 2.55, p = .06, \eta_p^2 = .067$, but not distress, $F(3, 106) = .88, p = .45, ns, \eta_p^2 = .024$. See

Table 6 for detailed results of the MANOVA and accompanying tests of the specific a priori hypotheses described below, and Table 7 for means of distress and negative affect for each condition.

Hypothesis 1.1: People in the Suppression condition will report more distress and negative affect than those in the Mindfulness and Cognitive Reappraisal conditions. The hypothesis that people in the Suppression condition would report more distress and negative affect than those in the Mindfulness and Cognitive Reappraisal conditions was tested with a planned contrast, for which the contrast weights were -2, 0, 1, 1 for the Suppression, Control, Mindfulness, and Cognitive Reappraisal conditions respectively. The multivariate test of this contrast, though trending in the predicted direction, was not significant, Wilks' Lambda = .971, $F(2, 105) = 1.57$, p = .21, $\eta_p^2 = .029$ (see Table 6). The univariate tests of this contrast showed that, compared to participants in the Mindfulness and Cognitive Reappraisal conditions, participants in the Suppression condition reported marginally more negative affect, $F(1, 106) = 2.70$, $p = .10$, $\eta_p^2 = .025$ (see Table 7). There was a nonsignificant trend in the predicted direction for distress, such that participants in the Suppression condition reported more distress than those in the Mindfulness and Cognitive Reappraisal conditions, $F(1, 106) = 1.85$, $p = .18$, *ns*, $\eta_p^2 = .017$.

Hypothesis 1.2: People in the Suppression and Control conditions will report more distress and negative affect than those in the Mindfulness and Cognitive Reappraisal conditions. The hypothesis that people in the Suppression and Control conditions would report more distress and negative affect than those in the Mindfulness

and Cognitive Reappraisal conditions was tested with a planned contrast, for which the contrast weights were -1, -1, 1, 1 for the Suppression, Control, Mindfulness, and Cognitive Reappraisal conditions respectively. The multivariate test of this contrast was significant, Wilks' Lambda = .942, $F(2, 105) = 3.22$, p < .05, $\eta_p^2 = .058$ (see Table 6). The univariate tests of this contrast showed that, compared to participants in the Mindfulness and Cognitive Reappraisal conditions, participants in the Suppression and Control conditions reported significantly more negative affect, $F(1, 106) = 6.30$, $p = .01$, $\eta_p^2 = .056$ (see Table 7). There was a similar though nonsignificant trend for distress, such that participants in the Suppression and Control conditions reported more distress than those in the Mindfulness and Cognitive Reappraisal conditions, $F(1, 106) = 2.40$, $p = .12$, ns, $\eta_p^2 = .022$.

Hypothesis 1.3: Testing whether there is a difference in distress and negative affect between the Suppression and Control conditions; expect either no difference between groups or more distress and negative affect in the Suppression condition. A planned contrast tested whether there was a significant difference in distress and NA between participants in the Suppression condition compared to the Control condition, with contrast weights of -1 and 1 respectively. The multivariate test of this contrast was not significant, Wilks' Lambda = .993, $F(2, 105) = .38$, $p = .68$, ns, $\eta_p^2 = .008$. Similarly, univariate tests of this contrast showed no significant differences: Participants in the Suppression and Control conditions reported comparable levels of both distress and NA.

Hypothesis 1.4: Testing whether there is a difference in distress and negative affect between the Mindfulness and Cognitive Reappraisal conditions; expect either no

difference between groups or more distress and negative affect in the Mindfulness

condition. Because there is theoretical reason to debate whether mindfulness is as

effective as cognitive reappraisal in preventing distress and negative affect, a planned

contrast was used to test whether there was a significant difference in distress and NA

between participants in the Mindfulness condition compared to the Cognitive Reappraisal

condition, with contrast weights of -1 and 1 respectively. The multivariate test of this

contrast was not significant, Wilks' Lambda = .990, $F(2, 105) = .56$, $p = .58$, *ns*, $\eta_p^2 =$

.008. Similarly, univariate tests of this contrast showed no significant differences:

Participants in the Mindfulness and Cognitive Reappraisal conditions reported

comparable levels of both distress and NA.

Differences in Food Consumption by Emotion Regulation Condition

    Hypothesis 2. Different types of emotion regulation will be differentially

related to eating behavior post- emotion-induction. I predicted that emotion regulation

condition (IV; Suppression, neutral Control, Mindfulness/Acceptance, Cognitive

Reappraisal) would be associated with amount of snack food consumed post- emotion-

induction. Participants in the Suppression condition were predicted to eat more food than

those in the Mindfulness and Cognitive Reappraisal conditions, as well as more than

those in the Control. No difference in amount consumed was expected between those in

the Mindfulness condition compared to the Cognitive Reappraisal condition.

    Outcome variables were the amount consumed (by weight in grams) for each of

the three foods in the tasting activity: bland crackers, potato chips, and M&Ms. In these

data, the amount of M&Ms consumed was uncorrelated with the other two food outcomes

(r's = -.01 for crackers and .06 for chips); however, the amounts of crackers and chips consumed were moderately correlated, $r(112) = .40$, $p < .05$. Because this is a relatively modest correlation, and because in previous studies these two foods have yielded different patterns of results (see Evers et al., 2010), the decision was made to conduct one-way ANOVAs with a set of three planned contrasts for each of the three snack foods separately. In order to be able to compare the pattern of results across the three foods, the measured amounts consumed were converted to standard scores prior to conducting the analyses.

The first contrast tested the Suppression condition against the Mindfulness and Cognitive Reappraisal conditions, the second tested the Suppression condition against the Control condition, and the third contrast tested the Mindfulness condition against the Cognitive Reappraisal condition. A priori contrast weights (see Table 8) to test these hypotheses were identified based on the recommendations of Klockars and Sax (1986). Because (contrary to the predictions about distress and negative affect) I expected to find a difference between the Suppression and Control conditions, and, based on previous research (e.g, Evers et al., 2010) did not predict a significant difference between the Control condition compared to the Mindfulness and Reappraisal conditions, there was no contrast comparing Suppression and Control conditions versus Mindfulness and Cognitive Reappraisal conditions. Table 9 displays means and standard deviations for all three foods across conditions. See Table 10 for additional details of the results of the ANOVAs and planned contrasts for the effects of Condition on each of the three food outcomes.

Hypothesis 2a: Differences in consumption of bland crackers (food A) by ER

condition. An ANOVA was used to compare across conditions the amount of crackers

consumed. The main effect for condition was not significant, but was trending toward

significance, $F(3, 110) = 1.95$, $p = .13$, $\eta_p^2 = .050$. The results of the planned contrasts

testing each of the specific predictions are reported below.

Hypothesis 2.1a: Participants in the Suppression condition will consume more

crackers than participants in the Mindfulness and Cognitive Reappraisal conditions. The

results of the planned contrast support this hypothesis. Participants in the Suppression

condition ate significantly more crackers than did participants in either the Mindfulness

or Cognitive Reappraisal conditions, $F(1, 110) = 5.82$, $p = .02$, $\eta_p^2 = .050$.

Hypothesis 2.2a: Participants in the Suppression condition will consume more

crackers than participants in the Control condition. The results of the planned contrast do

not show a significant difference between the Control condition and the Suppression

condition in terms of the amount of crackers consumed; however, there is a trend in the

hypothesized direction, $F(1, 110) = 2.18$, $p = .14$, *ns*, $\eta_p^2 = .019$.

Hypothesis 2.3a: Participants in the Mindfulness condition will not consume more

crackers than participants in the Cognitive Reappraisal condition. As predicted, there

was no significant difference between the Mindfulness and Cognitive Reappraisal

conditions in terms of the amount of crackers consumed, $F(1, 110) = .01$, $p = .94$, *ns*, η_p^2

$= .000$.

Hypothesis 2b: Differences in consumption of potato chips (food B) by ER

condition. An ANOVA was used to compare across conditions the amount of potato

chips consumed. The main effect for condition was not significant, $F(3, 110) = .82$, $p = .48$, ns, $\eta_p^2 = .022$. The results of the planned contrasts testing each of the specific predictions are reported below.

Hypothesis 2.1b: Participants in the Suppression condition will consume more chips than participants in the Mindfulness and Cognitive Reappraisal conditions. The results of the planned contrast do not support this hypothesis. Participants in the Suppression condition did not eat significantly more chips than did participants in either the Mindfulness or Cognitive Reappraisal conditions, $F(1, 110) = .68$, $p = .41$, ns, $\eta_p^2 = .006$.

Hypothesis 2.2b: Participants in the Suppression condition will consume more chips than participants in the Control condition. The results of the planned contrast do not show a significant difference between the Suppression and Control conditions in amount of chips consumed; rather, participants in the two conditions ate a comparable amount of chips, $F(1, 110) = .001$, $p = .98$, ns, $\eta_p^2 = .000$.

Hypothesis 2.3b: Participants in the Mindfulness condition will not consume more chips than participants in the Cognitive Reappraisal conditions. As predicted, there was no significant difference between the Mindfulness and Cognitive Reappraisal conditions in terms of the amount of chips consumed, $F(1, 110) = 1.43$, $p = .24$, ns, $\eta_p^2 = .013$. However, the trend in the data showed that people in the Mindfulness condition ate slightly more chips than did people in the Cognitive Reappraisal condition.

Hypothesis 2c: Differences in consumption of chocolate M&Ms (food C) by ER condition. An ANOVA was used to compare across conditions the amount of M&Ms

consumed. The main effect for condition was marginally significant, $F(3, 110) = 2.50$, p = .06, $\eta_p^2 = .064$. The results of the planned contrasts testing each of the specific predictions are reported below.

Hypothesis 2.1c: People in the Suppression condition will consume more M&Ms than participants in the Mindfulness and Cognitive Reappraisal conditions. The results of the planned contrast support this hypothesis, $F(1, 110) = 6.88$, $p = .01$, $\eta_p^2 = .059$. Participants in the Suppression condition ate significantly more M&Ms than did participants in either the Mindfulness or Cognitive Reappraisal conditions.

Hypothesis 2.2c: Participants in the Suppression condition will consume more M&Ms than participants in the Control condition. The results of the planned contrast show a significant difference between the Control condition and the Suppression condition in the hypothesized direction, $F(1, 110) = 4.47$, $p = .04$, $\eta_p^2 = .039$. Participants in the Suppression condition ate significantly more M&Ms than did those in the Control condition.

Hypothesis 2.3c: Participants in the Mindfulness condition will not consume more M&Ms than participants in the Cognitive Reappraisal conditions. As predicted, there was no significant difference between the Mindfulness and Cognitive Reappraisal conditions in terms of the amount of M&Ms consumed, $F(1, 110) = .14$, $p = .71$, ns, $\eta_p^2 = .001$.

Do Distress and Negative Affect Independently Predict Eating Behavior?

Post- emotion-induction distress and negative affect will not independently predict eating behavior. Based on previous research, distress and negative affect alone

were not expected to predict eating behavior (as measured by the amount consumed following emotion induction). Pearson correlations were used to examine 1) the relation between distress and each of the three eating outcomes, and 2) the relation between negative affect and each of the three eating outcomes. Distress was unrelated to the amount consumed of any of the three foods (all r's $\leq$ .16). Negative affect was unrelated to the amount consumed of two of the three foods (crackers, M&Ms), and showed a small correlation, $r(110) = .21$, $p < .05$, with the third food outcome (chips).

Interaction Effects of Habitual Emotion Regulation Style by ER Condition

Hypothesis 4. Trait emotion regulation will moderate the relation between emotion regulation condition and eating behavior post- emotion-induction. I predicted an interaction between trait emotion regulation and emotion regulation condition in amount of snack food consumed. Based on previous research, people higher in trait emotion suppression (as measured by the ERQ suppression subscale), and in difficulty regulating negative emotion (as measured by higher scores on the DERS) and people lower in expectancies for regulating negative mood (as measured by lower scores on the NMR) were expected to eat more snack foods following the emotion-induction, particularly if they were also in the Suppression condition. These hypotheses were tested by conducting a series of separate two-way ANOVAs (condition: Suppression, Control, Mindfulness, Cognitive Reappraisal X trait emotion regulation measure [ERQ-S, DERS, NMR]: low and high) with planned contrasts for each of the three snack foods separately. For each interaction, the trait emotion regulation measure (i.e., ERQ-S, DERS, NMR)

was dichotomized with a median split into low and high groups, with assigned weights of -1 and 1 respectively.

For each interaction, a pair of planned orthogonal contrasts was conducted. The first contrast tested whether, between low and high trait emotion regulation groups, there was a difference in the Suppression condition versus the Mindfulness and Cognitive Reappraisal conditions. The second contrast tested whether there was a difference between low and high trait emotion regulation groups in the Suppression condition against the Control condition (see Table 11 for these interaction contrast weights).

Hypothesis 4.1. Interaction between condition and ERQ-S predicting amount of snack food consumed. I predicted that people in the Suppression condition, but not the other conditions, would differ in amount of snack food consumed based on reported habitual emotional suppression.

Hypothesis 4.1a. Interaction effect for ERQ-Suppression by Condition for Food A – Crackers. Overall, the interaction was not significant, $F(3, 106) = .51$, $p = .68$, *ns*, $\eta_p^2 = .014$. Similarly, neither of the planned contrasts showed significant effects. Overall, there was no significant difference across conditions in amount of crackers consumed as a function of level of ERQ-Suppression (see Table 12 for more detailed results).

Hypothesis 4.1b Interaction effect for ERQ-Suppression by Condition for Food B – Chips. Overall, the interaction was not significant, $F(3, 106) = .05$, $p = .99$, *ns*, $\eta_p^2 = .001$. Similarly, neither of the planned contrasts showed significant effects. Overall, there was no significant difference across conditions in the relation between level of ERQ-Suppression and amount of chips consumed (see Table 12).

Hypothesis 4.1c. Interaction effect for ERQ-Suppression by Condition for Food C – M&Ms. Overall, the interaction was not significant, but showed a trend toward significance $F(3, 106) = 1.58$, $p = .20$, *ns*, $\eta_p^2 = .042$. Contrast 1 tested whether the difference between low- and high- ERQ-Suppression groups in amount consumed was significantly different between the Suppression condition and the Mindfulness and Cognitive Reappraisal conditions. There was a significant difference in the predicted direction, $F(1, 106) = 4.29$, $p = .04$, $\eta_p^2 = .039$, such that participants in the Suppression condition who were also high in ERQ-Suppression ate significantly more than those in the Suppression condition who were low in ERQ-Suppression (see Figure 2). In contrast, those in the Mindfulness and Cognitive Reappraisal showed no difference in amount consumed between low- and high- ERQ-Suppression groups (see Table 16).

Contrast 2, which tested whether the difference between low- and high- ERQ-Suppression groups in amount consumed was significantly different between the Control condition compared to the Suppression condition, was marginally significant, $F(1, 106) = 2.99$, $p = .09$, $\eta_p^2 = .027$. Participants in the Suppression condition who were also high in ERQ-Suppression ate significantly more than those in the Suppression condition who were low in ERQ-Suppression. In contrast, those in the Control condition showed no difference in amount consumed between low- and high- ERQ-Suppression groups (see Figure 2).

Hypothesis 4.2. Interaction between condition and DERS. I predicted that people in the Suppression condition, but not the other conditions, would differ in amount of snack food consumed based on reported difficulty in regulating emotions.

Hypothesis 4.2a Interaction effect for DERS by Condition for Food A – Crackers.
Overall, the interaction, while not significant, was trending toward significance, $F(3, 106)$
= 1.84, p = .14, η_p^2 = .050. Contrast 1 tested whether the difference between low and high
DERS groups in amount consumed was significantly different between the Suppression
condition and the Mindfulness and Cognitive Reappraisal conditions. There was a
marginally significant effect in the predicted direction, $F(1, 106)$ = 2.74, p = .10, η_p^2 =
.025, such that participants in the Suppression condition who were also high in DERS ate
more than those in the Suppression condition who were low in DERS. In contrast, those
in the Mindfulness and Cognitive Reappraisal conditions showed either no difference in
amount consumed between low and high DERS groups (CR) or ate fewer crackers in the
high DERS group (M); see Figure 3.

Contrast 2, which tested whether the difference between low and high DERS
groups in amount consumed was significantly different in the Control condition
compared to the Suppression condition, was significant, $F(1, 106)$ = 4.38, p = .04, η_p^2 =
.040. Participants in the Suppression condition who were also high in DERS ate
significantly more than those in the Suppression condition who were low in DERS. In
contrast, those in the Control condition who were high in DERS actually ate fewer
crackers than their counterparts low in DERS (see Table 13 for more detailed results).

Hypothesis 4.2b Interaction effect for DERS by Condition for Food B – Chips.
Overall, the interaction was not significant, $F(3, 106)$ = .94, p = .43, *ns*, η_p^2 = .025.
Similarly, neither of the planned contrasts showed significant effects, although
participants in the Suppression condition who were in the high DERS group ate

marginally more than did their low-DERS counterparts. There was a trend in the data in the direction of the hypothesized difference, such that people in the Suppression condition ate more when in the high DERS group compared to the low DERS group. This pattern was in contrast to that of the Cognitive Reappraisal and Control conditions, as predicted. However, counter to prediction, no significant difference between the Mindfulness and Suppression conditions were observed.

Hypothesis 4.2c Interaction effect for DERS by Condition for Food C – M&Ms. Overall, the interaction was not significant, $F(3, 106) = .07$, $p = .97$, *ns*, $\eta_p^2 = .002$. Similarly, neither of the planned contrasts was significant. Thus, there was no significant difference in amount of M&Ms consumed between low and high DERS groups for any of the four emotion regulation conditions. Rather, regardless of DERS, participants in the Suppression condition ate more M&Ms than participants in any of the other three conditions (the contrasts testing specific predictions for the main effect of Condition is detailed above in Hypothesis 2.1c and Hypothesis 2.2c.)

Interaction Effects: Eating Expectancies by Condition

Hypothesis 5. Eating expectancies for mood regulation will moderate the relation between emotion regulation condition and eating behavior post- emotion-induction. Previous research has shown that people who expect eating to reduce negative emotions are more likely to engage in overeating (e.g., binge eating, emotional eating). People who engage in more emotional eating (as measured by the Emotional Eating subscale of the Dutch Eating Behavior Questionnaire [hereafter, DEBQ-EE]; van Strien et al., 1986) were expected to eat more snack food following the emotion-induction.

Similarly, people with higher expectancies that eating will reduce negative affect (as measured by the Negative Affect subscale of the Eating Expectancies Inventory [hereafter EEI-NA]; Hohlstein et al., 1998) were expected to consume more snack food. Specifically, I expected there to be an interaction such that this pattern of increased consumption in the high DEBQ-EE and high EEI-NA groups would occur in the Suppression condition, but not in the other three conditions.

These hypotheses were tested by conducting a series of separate two-way ANOVAs (condition: Suppression, Control, Mindfulness, Cognitive Reappraisal X eating expectancies measure [DEBQ-EE, EEI-NA]: low and high) with planned contrasts for each of the three snack foods separately. For each interaction, the eating expectancies measure (i.e., DEBQ-EE, EEI-NA) was dichotomized into low and high groups, with assigned weights of -1 and 1 respectively.

For each interaction, a pair of planned orthogonal contrasts was conducted. The first contrast tested whether, between the low and high eating expectancies groups, there was a difference in the Suppression condition compared to the Mindfulness and Cognitive Reappraisal conditions, whereas the second tested whether there was a difference between low and high eating expectancies groups in the Suppression condition compared to the Control condition (see Table 11 for these interaction contrast weights).

Hypothesis 5.1 Interaction between condition and DEBQ-EE. I predicted that participants in the Suppression condition who were also in the high DEBQ-EE group would eat more than those who were in the low DEBQ-EE group.

Hypothesis 5.1a Interaction effect for DEBQ-EE by Condition for Food A –

Crackers. Overall, the interaction was not significant, $F(3, 106) = .52$, $p = .67$, *ns*, $\eta_p^2 =$

.015. There were no significant differences between any of the conditions in the amount

of crackers consumed for low and high-DEBQ-EE groups (see Table 14 for more detailed

results). Instead, regardless of level of DEBQ-EE, participants in the Suppression

condition ate more crackers than participants in any of the other three conditions (the

contrasts testing specific predictions for the main effect of Condition are detailed above

in Hypothesis 2.1a and Hypothesis 2.2a).

Hypothesis 5.1b Interaction effect for DEBQ-EE by Condition for Food B –

Chips. Overall, the interaction was not significant, $F(3, 106) = .07$, $p = .98$, *ns*, $\eta_p^2 = .002$.

There were no significant differences between any of the conditions in the amount of

chips consumed for low and high DEBQ-EE groups. Instead, regardless of level of

DEBQ-EE, participants in the Cognitive Reappraisal condition ate a smaller amount of

chips than participants in any of the other three conditions.

Hypothesis 5.1c Interaction effect for DEBQ-EE by Condition for Food C –

M&Ms. Overall, the interaction was marginally significant, $F(3, 106) = 2.62$, $p = .06$, *ns*,

$\eta_p^2 = .063$. Contrast 1 tested whether the difference between low and high DEBQ-EE

groups in amount consumed was significantly different between the Suppression

condition, compared to the Mindfulness and Cognitive Reappraisal conditions. There was

a significant difference in the predicted direction, $F(1, 106) = 7.19$, $p < .01$, $\eta_p^2 = .063$,

such that participants in the Suppression condition who were also high in DEBQ-EE ate

significantly more than those in the Suppression condition who were low in DEBQ-EE

(see Figure 4). In contrast, those in the Mindfulness and Cognitive Reappraisal conditions showed no difference in amount consumed between low and high DEBQ-EE groups (see Table 16). Similarly, Contrast 2 found a significant difference between low and high DEBQ-EE groups in amount consumed for the Control condition compared to the Suppression condition, $F(1, 106) = 4.95$, $p = .03$, $\eta_p^2 = .045$. Participants in the Suppression condition who were also high in DEBQ-EE ate significantly more M&Ms than those in the Suppression condition who were low in DEBQ-EE. In contrast, those in the Control condition showed no difference in amount consumed between low and high DEBQ-EE groups (see Table 14 for more detailed results).

Hypothesis 5.2 Interaction between condition and EEI-NA. I predicted that people in the Suppression condition, but not the other conditions, would differ in amount of snack food consumed based on level of expectancies that eating will reduce negative affect.

Hypothesis 5.2a Interaction effect for EEI-NA by Condition for Food A – Crackers. Overall, the interaction was not significant, $F(3, 106) = .56$, $p = .64$, *ns*, $\eta_p^2 = .014$. There were no significant differences between any of the conditions in comparing the amount of crackers consumed for low and high EEI-NA groups (see Table 15 for more detailed results). Instead, regardless of level of EEI-NA, participants in the Suppression condition ate more crackers than participants in any of the other three conditions.

Hypothesis 5.2b Interaction effect for EEI-NA by Condition for Food B – Chips. Overall, the interaction was not significant but was trending toward significance, $F(3,$

106) = 1.79, $p = .15$, ns, $\eta_p^2 = .048$. Contrast 1, testing for differences in chip

consumption across EEI-NA groups, comparing the Suppression condition to the

Mindfulness and Cognitive Reappraisal conditions, showed no significant difference.

Contrast 2, which tested for differences between the Suppression and Control conditions,

showed significant differences between low- and high- EEI-NA in the amount of chips

consumed, $F(1, 106) = 5.11$, $p = .03$, $\eta_p^2 = .046$. Specifically, for the Control condition,

people in the high EEI-NA group ate more chips than did those in the low EEI-NA group.

In contrast, for the Suppression condition, people in the low EEI-NA group ate more

chips than did their counterparts in the high EEI-NA group. The obtained pattern of

results for the Suppression group is counter to the prediction that people in the

Suppression group and higher in EEI-NA would eat more than those lower in EEI-NA.

Hypothesis 5.2c Interaction effect for EEI-NA by Condition for Food C – M&Ms.

Overall, the interaction was significant, $F(3, 106) = 2.99$, $p = .03$, $\eta_p^2 = .078$. Contrast 1

tested whether the difference between low and high EEI-NA groups in amount consumed

was significantly different between the Suppression condition, compared to the

Mindfulness and Cognitive Reappraisal conditions. There was a significant difference in

the predicted direction, $F(1, 106) = 8.21$, $p < .01$, $\eta_p^2 = .072$, such that participants in the

Suppression condition who were also high in EEI-NA ate significantly more than those in

the Suppression condition who were low in EEI-NA. In contrast, those in the

Mindfulness and Cognitive Reappraisal conditions ate fewer M&Ms overall, and showed

no difference in amount consumed between low and high EEI-NA groups (see Figure 4).

Contrast 2 found a significant difference between low- and high- EEI-NA groups in amount consumed for the Control condition compared to the Suppression condition, $F(1, 106) = 5.69$, $p = .02$, $\eta_p^2 = .051$. Participants in the Suppression condition who were also high in EEI-NA ate significantly more M&Ms than those in the Suppression condition who were low in EEI-NA. In contrast, those in the Control condition showed no difference in amount consumed between low and high EEI-NA groups.

Interaction Effects: Post- Emotion-Induction Distress and Negative Affect by Condition

Hypothesis 6. Post- emotion-induction negative affect and distress will moderate the relation between emotion regulation condition and eating behavior post-emotion-induction. I expected that the effects of the assigned emotion regulation strategy would have the greatest impact on people who reported more distress or NA following the emotion induction. These hypotheses were tested by conducting a series of separate two-way ANOVAs (condition: Suppression, Control, Mindfulness, Cognitive Reappraisal X distress [Distress-SUDS, NA]: low and high) with planned contrasts for each of the three snack foods separately. For each interaction, the measure of negative affect or distress was dichotomized into low and high groups, with assigned weights of -1 and 1 respectively.

For each interaction, a pair of planned orthogonal contrasts was conducted. The first contrast tested whether, between the low and high distress groups, there was a difference in the Suppression condition compared to the Mindfulness and Cognitive Reappraisal conditions, while the second tested whether there was a difference between

low and high distress groups in the Suppression condition compared to the Control condition (see Table 11 for these interaction contrast weights).

Hypothesis 6.1 Interaction between condition and negative affect. I predicted that for people in the Suppression condition, those reporting more negative affect would eat more.

Hypothesis 6.1a Interaction effect for NA by Condition for Food A – Crackers. Overall, the interaction was not significant, $F(3, 106) = 1.41$, $p = .24$, *ns*, $\eta_p^2 = .038$. The planned contrast tests showed a marginally significant difference in the interaction between condition and NA in terms of the amount of crackers consumed, $F(1, 106) = 2.85$, $p = .09$, $\eta_p^2 = .026$ (see Table 18). Specifically, contrary to prediction, participants in the Suppression group who reported *less* negative affect ate more crackers, while the amount of crackers consumed by participants in the Mindfulness and Cognitive Reappraisal conditions did not differ by level of reported NA (see Figure 6).

Hypothesis 6.1b Interaction effect for NA by Condition for Food B – Chips. Overall, the interaction was significant, $F(3, 106) = 3.58$, $p = .02$, $\eta_p^2 = .092$. The planned contrast tests showed a significant interaction between condition and NA in terms of the amount of chips consumed between the Suppression condition compared to the Cognitive Reappraisal and Mindfulness conditions, $F(1, 106) = 9.94$, $p < .01$, $\eta_p^2 = .086$, and between the Suppression and Control conditions, $F(1, 106) = 6.73$, $p = .01$, $\eta_p^2 = .060$. Specifically, counter to prediction, participants in the Suppression group who reported less negative affect ate more chips, while the amount of chips consumed by participants

in the Mindfulness, Cognitive Reappraisal, and Control conditions was higher for those reporting more negative affect (see Figure 7).

Hypothesis 6.1c Interaction effect for NA by Condition for Food C – M&Ms. Overall, the interaction was not significant, $F(3, 106) = .38$, $p = .77$, *ns*, $\eta_p^2 = .011$. Neither of the planned contrast tests showed a significant interaction between condition and NA in terms of the amount of M&Ms consumed for the Suppression condition compared to the other conditions.

Hypothesis 6.2 Interaction between condition and Distress-SUDS. I predicted that for people in the Suppression condition (but not the other conditions), those reporting more distress would eat more (see Table 17).

Hypothesis 6.2a Interaction effect for Distress by Condition for Food A – Crackers. Overall, the interaction was not significant, $F(3, 104) = .85$, $p = .47$, *ns*, $\eta_p^2 = .024$, though there were significant main effects for both distress, $F(1, 104) = 6.82$, $p = .01$, $\eta_p^2 = .062$, and condition, $F(3, 104) = 2.79$, $p = .04$, $\eta_p^2 = .074$ (see Table 19). Neither of the planned contrasts showed significant effects. The main effect for distress was counter to prediction, such that for all groups, but particularly the Suppression group, people reporting more distress actually ate less than did their counterparts reporting less distress.

Hypothesis 6.2b Interaction effect for Distress by Condition for Food B – Chips. Overall, the interaction was not significant, $F(3, 104) = 1.17$, $p = .33$, *ns*, $\eta_p^2 = .033$. The planned contrast analyses showed a marginally significant difference in the interaction between condition and distress in terms of the amount of chips consumed, $F(1, 104) =$

3.30, $p = .07$, $\eta_p^2 = .031$, such that participants in the Suppression group who reported more distress ate fewer chips, while participants in the Control group who reported more distress ate nonsignificantly more than those who reported lower levels of distress.

Hypothesis 6.2c Interaction effect for Distress by Condition for Food C – M&Ms. Overall, the interaction was significant, as were the specific planned contrasts. People in the Suppression condition who reported low levels of distress ate more M&Ms than did their counterparts who reported more distress. This was significantly different than the eating behavior of people in the Mindfulness and Cognitive Reappraisal conditions, $F(1, 104) = 7.62$, $p < .01$, $\eta_p^2 = .068$, and the Control condition, $F(1, 104) = 5.77$, $p = .02$, $\eta_p^2 = .053$, who all ate fewer M&Ms, regardless of reported level of distress (see Figure 8).

Discussion

The primary goal of the present study was to conduct a controlled comparison of the effects of several emotion regulation strategies, including suppression, cognitive reappraisal, and a new mindfulness/acceptance strategy, on subsequent eating behavior and affect. Secondarily, the study allowed testing for interactions between assigned emotion regulation condition and key theoretically relevant measures – trait emotion regulation (ERQ-S, DERS), emotional eating/expectancies (DEBQ-EE, EEI-NA), and negative affect (PANAS-NA, Distress SUDS) – on eating outcomes. To my knowledge, this study represents the first test of mindfulness as an emotion regulation condition in a controlled emotion induction with eating behavior as the outcome. As such, it provides additional support for the use of acceptance and mindfulness-based interventions for dysregulated eating. In this section, I will discuss each of the key findings in the context

of the existing research literature, as well as highlight a few unanswered questions and explore future avenues of research and clinical application.

The present study tested the link between emotion regulation styles, negative affect, and eating behavior. Use of emotional suppression was associated with more distress, negative affect, and greater overall consumption of sweets and crackers, but not potato chips. Cognitive reappraisal and mindfulness were equivalent in producing lower levels of distress, negative affect, and eating behavior. Results also showed that habitual suppression, difficulty with emotion regulation, emotional eating, expectancies that eating will reduce negative affect, and amount of distress or negative affect reported moderated the effect of emotion regulation condition on eating outcomes, particularly the amount of sweets eaten. However, results were not consistent across all snack types, particularly for the interaction analyses; factors potentially contributing to these discrepancies are further discussed below.

Effects of Emotion Regulation on Negative Affect or Distress

Overall, suppression of emotional expression was associated with more negative affect and distress. People in the Suppression and Control conditions reported more negative affect and marginally more distress than people in the Mindfulness or Reappraisal conditions. The more ambiguous difference in distress may have had more to do with the measurement problem inherent in using a one-item distress measure with a very large range (0 – 100), which resulted in standard deviations so large that any potential group differences could not precisely be discerned. These findings are consistent with some of the existing literature on the effects of suppression, including

naturalistic studies (Nezlek & Kuppens, 2008) as well as correlational studies of individuals with PTSD (Moore et al., 2008) and experimental studies of depressed individuals (Campbell-Sills et al., 2006).

In contrast, as noted in a recent meta-analysis (Webb et al., 2012), others have found that suppression is associated with lower levels of distress. These differences may be related to differences in the suppression task (i.e., suppression of only the facial expression of emotion versus suppression of the internal experience and outward expression of emotion) and outcome measures (i.e., self-report affect versus rater coding of the behavioral [facial expressions] of affect). More specifically, when the suppression task is to suppress the outward expression of emotion and the measure of distress is rater coding of facial expressions (e.g., Gross & Levenson, 1993), then suppression is clearly associated with lower levels of rater-perceived distress. In the current study, however, only participants' perception of distress was assessed, because one of the key aims was to examine the role of participants' *experienced* affect in subsequent eating behavior. This difference in metric is the likely explanation for this apparently discrepant pattern of results; in fact, when only self-report outcomes are examined, aggregate data show a much lower association between suppression and affect (see Webb et al., 2012 for more detailed review).

Effects of Emotion Regulation on Eating Behavior

Suppression was associated with more snacking. There was an effect of emotion regulation condition on snacking behavior such that people in the Suppression condition on average ate more than did those in the Mindfulness or Cognitive Reappraisal

conditions. This held true for two of the three snack foods tested (chocolate and crackers) but not for the third (potato chips). It is not entirely clear why a different pattern was observed for potato chip consumption, but closer examination of the results shows that people in the Mindfulness condition ate a similar amount of chips as those in the Suppression and Control conditions.

Additionally, in terms of eating behavior (but not negative affect or distress) people in the neutral no-instruction Control condition ate amounts more similar to those in the Mindfulness and Cognitive Reappraisal conditions. This finding is in line with the results from a similar study by Evers and colleagues (2010), which found that the no-instruction control and reappraisal conditions did not differ in amount eaten. Thus, it is it not the case that mindfulness and reappraisal are providing a boost in self-regulatory ability over and above that observed in the control condition. Rather, it seems that use of suppression has an actively negative impact on ability to self-regulate eating behavior.

However, it is important to recall that though people in the Control condition were not given a particular emotion regulation instruction, they may still have made use of one or more emotion regulation strategies. Previous research has shown that in naturalistic studies, people most commonly report using reappraisal (Nezlek & Kuppens, 2008). If most people in the no-instruction Control condition used some form of reappraisal, the similarity between the Control and the adaptive emotion regulation conditions such as Mindfulness and Cognitive Reappraisal is unsurprising, and in fact, data from the manipulation check do support this explanation. On the other hand, this explanation is not consistent with the observed similarity between the Suppression and Control conditions

in reported negative affect and distress. Additional research is needed to more fully explicate the emotion regulation processes occurring within the no-instruction Control.

Compared to Cognitive Reappraisal, Mindfulness was equally effective as an emotion regulation strategy. Overall, across all analyses there were no significant differences between the Mindfulness strategy and the Cognitive Reappraisal strategy. Participants in the Mindfulness and Cognitive Reappraisal conditions reported similar levels of distress and negative affect; both groups reported less distress and NA than Control and Suppression conditions. This finding is somewhat in contrast with that of Hofmann et al. (2009), who found no differences in physiological indicators of arousal between cognitive reappraisal and acceptance conditions, but noted a slight advantage to reappraisal compared to acceptance in terms of perceived anxiety or distress.

Similarly, there were no statistically or practically significant differences in behavioral measures of self-regulation. Participants in the Cognitive Reappraisal and Mindfulness conditions ate a similar amount of snack foods (chocolate and crackers), which was less than the amount consumed by those in the Suppression condition. The only observed difference between groups was the previously mentioned trend such that people in the Reappraisal condition ate fewer chips than those in the Mindfulness condition. Even this observation does not address the question of why this pattern would differ from the results of the other two snack foods. In other lab studies that have compared the effects of mindfulness and reappraisal on various outcomes, though, any differences between the two have typically favored reappraisal (e.g., Wolgast, Lundh, & Viborg, 2011).

Moderation Effects

Moderation effects of negative affect and distress. Overall, there was not a direct significant relation between negative affect and distress and eating behavior. This finding is somewhat in contrast to the majority of field studies (e.g., Hilbert & Tuschen-Caffier, 2007; Kontinnen et al., 2010) that have found distress and NA to be associated with increased emotional eating and difficulty regulating eating behavior. However, some but not all, of the moderation analyses showed significant results. The interaction between distress and condition was found for only bland crackers and potato chips, whereas, in contrast, the interaction between NA and condition was found only for chocolate. More importantly, as predicted, these results showed a difference in the Suppression condition but not other conditions between high and low levels of NA or distress. Counter to expectation, however, when people in the Suppression condition reported more distress or negative affect after the film, they ate less. These results may be consistent with research showing that, though people who use suppression report less distress, they experience similar levels of physiological arousal (Dunn et al., 2009).

One possible explanation for these results that deserves further examination is that when people use avoidant or suppression ER strategies, they may be unaware of their own distress and thus less accurate self-reporters – though still behaviorally impacted by exposure to distressing stimuli. This idea is consistent with research (Hooper et al., 2012) showing a rebound effect, in which after initially successfully restricting chocolate intake, people who used suppression ate significantly more chocolate at follow-up. The current results suggest that even (or particularly) if individuals using suppression do not

perceive or report distress or negative affect, it can still negatively impact their eating behavior.

Moderation effect of habitual emotion regulation styles. Overall, results suggested that people who habitually relied on emotional suppression or reported difficulty with regulating negative emotions ate significantly more of some snacks when assigned to the suppression condition than any other condition. However, findings from the planned moderation contrast analyses were mixed. Specifically, the predicted interaction between ERQ-S and ER condition was only found for chocolate, whereas the predicted interaction between DERS and condition was found only for bland crackers. Based on these findings, it appears that use of suppression produces more interference in subsequent behavioral self-regulation for people who already tend to rely on suppression or have difficulty with emotion regulation. It is interesting to note that, in this case, those high in habitual suppression (ERQ-S) or DERS, when left to their own devices in the neutral control condition ate no more than people low in ERQ-S or DERS. Though the current data do not allow further clarification of this finding, I speculate that in response to a more stressful or intense emotional stimulus, people in a no-instruction Control condition also high in ERQ-S or DERS would demonstrate a pattern more similar to those in the suppression condition.

The significant interactions are in contrast to the findings of Wolgast et al. (2011), who reported no interaction of habitual emotion regulation strategy for the effect of assigned emotion regulation condition (reappraisal, acceptance, or neutral control) on various self-report and physiological measures of affective distress. However, Wolgast et

al. focused on a different set of outcome variables (physiological measures of distress) than those in the current study (eating behavior). More importantly, in the current study, the interaction with habitual emotion regulation strategies only occurred for participants assigned to suppress their emotional reactions, which was not one of the conditions in Wolgast et al.'s design.

Moderation effect of emotional eating. Emotional suppression brought out the worst (eating behavior) in people who tend toward emotional eating or have expectancies that eating will reduce negative affect. This effect, found only for the amount of chocolate eaten, was consistent with other findings on the negative dietary impact of expectancies that eating will reduce negative affect (e.g., Sproesser et al., 2011). The interaction between the use of emotional suppression and reported tendency toward emotional eating suggests a possible explanation for results of other studies showing no direct relationship between emotional eating and snacking (Adriaanse, de Ridder, & Evers, 2011). Specifically, tendency toward emotional eating may result in overconsumption only in the context of negative affect and/or greater cognitive load, as in the application of an effortful inhibitory process such as suppression.

Limitations

The current study was conducted in a general population (i.e., not limited to people with dysregulated or disordered eating). Though conceptually similar results have been found in broader-scale intervention research, this study is not able to directly draw conclusions about the behavior of people with clinically or medically significant problematic eating behavior.

Though the results overall support the hypotheses and interactions proposed, the pattern of findings also leaves some interesting questions to ponder and address in future research.

1. Why wasn't more of a difference observed between the Control participants who received no emotion regulation instructions and the participants who received the (putatively beneficial) Cognitive Reappraisal and Mindfulness instructions? Although the data do not allow a firm conclusion to be drawn, there are a couple of likely contributing factors. Research on naturally occurring emotion regulation strategies found that when people were left to their own devices without specific emotion regulation instruction, they were more likely to use reappraisal than suppression (Volokov & Demaree, 2010). In the absence of any specific instruction, it is probable that more participants in the Control condition used reappraisal strategies, and this is supported by the results of the manipulation check data.

Additionally, it is important to recall that the emotion regulation stimulus used was quite mild (a brief sad excerpt from a popular movie). Thus the emotion regulation demands of the task were minor and related to a stimulus that was clearly fictional and not personal to the individual. Previous research (Aldao & Nolen-Hoeksema, 2012) has found that reappraisal and mindfulness strategies are used much less consistently across situations than is suppression. There is also evidence (Sheppes et al., 2011, 2012) that for low intensity stimuli, people most commonly choose to use reappraisal, but for high intensity stimuli, people are more likely to turn to distraction (an avoidance-based strategy). Thus, it is probable that experiencing a more intense or more personal stimulus

would not only increase the negative affect and distress experienced, but also make it more likely that people would use suppression but inconsistently apply more beneficial strategies such as reappraisal or mindfulness. There might also be differential effects on emotional eating, as some research (Torres & Nowson, 2007) has shown that under stress, change in eating behavior is bimodal, with some people reporting increased consumption and others decreased appetite.

2. *Why were the observed effects found for some foods (particularly M&Ms) but not others?* In their study, Evers et al. (2010) found that emotion regulation condition had similar effects on consumption of M&Ms and potato chips, but not bland crackers. This is consistent with the authors' classification of bland crackers as a low-caloric, low-palatability food and both M&Ms and chips as high-caloric, high-palatability foods. Taut et al. (2012) only examined effects of emotion regulation on consumption of chocolate and chips, but similarly showed a difference between reappraisers and suppressors for both foods. In contrast, in the current study, I found similar effects of emotion regulation condition for M&Ms and bland crackers, but not potato chips. This inconsistency in results is puzzling.

However, in conjunction with the observed pattern of moderation results in the current study, most of which show effects only for amount of M&Ms eaten, one possibility is presented. Perhaps the effects of emotion regulation on eating behavior is more robust for high-caloric sweets overall. Chocolate is a food that is both sweet and high-caloric, and is both empirically and stereotypically associated with eating to reduce negative affect (i.e., sitting on the couch eating a box of chocolates after a romantic

break-up). Participants in the current study reported more desire to eat the M&Ms and more enjoyment from eating the M&Ms, compared to the other two foods. It may be that crackers and chips are less universally enjoyed, with more individual variability in likelihood of greater consumption. Another potential source of variance could be cultural variations in eating patterns or preferences, as Evers et al.'s (2010) studies were conducted in the Netherlands and Taut et al.'s studies were conducted in Romania, whereas the current study was conducted in the Midwest of the United States.

It is also important to note with regard to the moderation analyses that a number of different tests were conducted, and not all the predicted effects were found. Most often (e.g., with ERQ-S, NA, DEBQ-EE, EEI-NA), the effects were found for chocolate but not other types of snacks, though in two cases (DERS and distress) the opposite pattern was observed. Overall, the results should be interpreted cautiously in light of the number of significant results compared to the number of tests conducted (see Abelson & Prentice, 1997). The exception to this note of caution is the seemingly clear evidence supporting an interaction between emotional eating and condition for sweets only; both measures of emotional eating or expectancies (DEBQ-EE and EEI-NA) showed very similar results with effect sizes in the upper range of small to moderate.

However, given the low correlation between some of the food outcomes and the subsequent decision to analyze the results for each food separately using ANOVA (rather than all three food outcomes in one MANOVA as originally intended), it is also important to consider that the ANOVA interaction analyses are underpowered to detect effects of the expected size (small to moderate). Thus, it is not possible to definitively

conclude from the present data that the ambiguous results in some of these interactions are due to an absence of a true effect. Additional studies with a larger sample and greater power to detect the predicted effects could help to further clarify the nature of the relations between trait emotion regulation, affect, and emotion regulation strategy for the various food outcomes.

Future Directions

Based on these findings and that of previous related studies (e.g., Evers et al., 2010; Taut et al., 2012; Wolgast et al., 2011), several directions for future research and clinical application are indicated.

What aspect of suppression produces problems in behavioral self-regulation? One important question that has developed from this and other work demonstrating benefits of strategies other than cognitive reappraisal is: What is the commonality among the emotion regulation strategies that promote (or at least do not interfere with) behavioral self-regulation? The corollary of this question is what aspect of suppression produces problems in behavioral self-regulation. There are a few possible avenues of approach suggested by previous literature. The original framing of Gross and colleagues (Gross & John, 2003; John & Gross, 2004; Rottenberg et al., 2007) suggests that timing is a key distinction between reappraisal and suppression. More specifically, they suggest that reappraisal is an *a priori* strategy to change the framing of an emotional stimulus before sustained exposure or emotional activation, whereas suppression is applied during and after exposure to the stimulus, to manage already occurring emotional activation.

However, a mindfulness or acceptance strategy also needs to be applied during and after exposure to the stimulus (e.g., observing, describing, and accepting any cognitive or emotional responses to the stimulus). The current results show that mindfulness has a significantly different impact on affect and eating behavior than does suppression, and in fact the results show no difference between mindfulness and cognitive reappraisal. As such, timing of the emotion regulation strategy may not be the key distinguishing factor between strategies that promote versus impair subsequent behavioral self-regulation.

Avoidance or inhibition of impulses is one aspect that potentially distinguishes suppression from more constructive emotion regulation strategies. Both avoidance and suppression have been shown to negatively impact eating behavior and affective symptoms (Aldao et al., 2010). The idea that avoidance is an important element in dysregulated emotional experience is also supported by other research. Regardless of assigned emotion regulation condition (suppression or reappraisal), people who looked toward – rather than away from – negative emotional images were more successful in regulating negative affect (Bebko, Franconeri, Ochsner, & Chaio, 2011). Recently, researchers have distinguished between suppressing the outward expression of emotion and suppressing inward experience of emotion (Webb et al., 2012). Further research into the role of avoidance and inhibition in emotional suppression could help shed light on the mechanisms by which suppression impairs later self-regulation.

Flexibility of emotion regulation strategies. A dual process model of emotion regulation (Gyurak, Gross, & Etkin, 2011) proposed that healthy emotion regulation is

not just the application of a particular emotion strategy; rather, they argued that a marker of healthy emotion regulation is having a diverse array of emotion regulation strategies that can be applied at will as appropriate. Evidence for this model comes from studies by Sheppes and colleagues (2011; 2012), including data showing that participants chose to use reappraisal during low-intensity emotion regulation tasks but preferred distraction during high-intensity stimuli. Similarly, others (Aldao & Nolen-Hoeksema, 2012) have found that adaptive emotion regulation strategies (e.g., reappraisal, acceptance) were used more contextually than maladaptive emotion regulation strategies (e.g., suppression, avoidance). Based on this contextual application, they argued that the ability to appropriately apply emotion regulation approaches based on situational needs is both adaptive and an indicator of mental health.

Clinical application. There are a number of ways to incorporate these findings into clinical intervention. For example, small specific instructions for emotion regulation applied to personal distress in individual or group interventions could be helpful in regulating distress and increasing behavioral self-regulation, especially for people who tend to engage in emotional suppression. The ERQ is a very brief measure that could have utility in identifying clinical patients who would be most likely to benefit from emotion regulation skills training. In particular, these strategies could be beneficial to individuals who are obese or engage in dysregulated eating (e.g., binge eating, poor compliance with diabetes management).

Gender, emotion regulation, and health behavior. In addition, there is some evidence to suggest that negative affect and emotion regulation may play a more

important role in eating behaviors for women than for men. Motivation for emotional

eating behavior may have a gendered affect asymmetry, in that women are more likely to

eat in response to negative affect and men more likely to eat in response to positive affect

(Dubé, LeBel, & Lu, 2005). Examining gender differences in emotion regulation and

mental health, Nolen-Hoeksema and colleagues (2012; Aldao & Nolen-Hoeksema, 2011)

found that women report using both adaptive and maladaptive emotion regulation

strategies more often than men, though this is not associated with any reduction in

depression symptoms. However, among those who reported high levels of maladaptive

emotion regulation styles, reporting higher levels of more adaptive coping skills appeared

to be a protective factor for women but not for men. Additionally, alexithymia has been

shown to be more related to emotional eating for obese men than obese women (Larsen,

van Strien, Eisinga, & Engels, 2006). Though not examined by Larsen et al., it suggests

that something other than difficulty with recognizing or identifying emotional responses

is implicated in emotional eating for women – perhaps emotional suppression, or

nonacceptance of emotional reactions. Lastly, the suppression of positive emotions

appears to negatively impact women more than men (Nezlek & Kuppens, 2008). Thus,

addressing deficits in emotion regulation skills may be of particular importance to target

when working on health behavior interventions for women.

Conclusions

Wegner's Ironic Process theory (1994; Wenzlaff & Wegner, 2000) has

demonstrated that thought suppression often produces counterproductive effects.

Application of ironic process theory to the study of restrained eating behavior has shown

that more salient restraint of thoughts or cues can increase the urge or desire for the food as well as greater actual consumption, particularly in the context of emotional suppression (Boon, Stroebe, Schut, & Ijntema, 2002; Svaldi, Tuschen-Caffier, Lackner, Zimmermann, & Naumann, 2012). The emotion regulation literature, particularly the work of Gross and colleagues (2003; 2004) has focused on suppression of emotional responses, rather than thoughts. The current study applied similar emotion regulation methodology (previously applied to the study of eating behavior, e.g., Evers et al., 2010), with the added emotion regulation strategy of mindfulness or acceptance.

In summary, the current findings confirm the deleterious effect of emotional suppression on subsequent self-regulation of eating behavior. More constructively, the results show equally positive results for mindfulness and cognitive reappraisal. Using emotional suppression has a particularly negative effect on self-regulation of eating behavior for people who report struggling with emotion regulation or frequent reliance on suppression. Additionally, people who tend toward emotional eating or expect that eating will reduce negative affect show more difficulty regulating eating behavior when asked to suppress their emotional responses. In contrast, people with these traits who were not instructed to use suppression had no more difficulty regulating eating behavior than those without the traits.

One of the key implications of this and similar studies is that brief instructions can produce significant short-term impact on observable health behaviors. People who habitually have difficulty regulating negative emotions or who habitually suppress emotions are the ones who were most negatively impacted by the instruction to suppress.

In the current study, the people in the no-instruction Control condition reported relying most heavily on cognitive reappraisal during the emotion induction. Based on previous research, it is reasonable to expect that even in the absence of explicit instruction to do so, people who generally tend toward suppression would be more likely to rely on suppression as an emotion regulation strategy for more impactful or personally distressing emotional experiences. Supplementing clinical interventions with emotion regulation skills training for only the individuals most likely to derive benefit could be a cost-effective way of increasing the efficacy of existing health behavior interventions.

Study 2: Emotion Regulation, Negative Affect, Expectancies, and Smoking

Study 2 used a survey methodology to compare the emotion regulation and affective profiles of daily smokers with those of nonsmokers. Additionally, Study 2 examined the associations between specific emotion regulation styles, expectations about smoking, and self-reported smoking behavior.

Literature Review

Consequences of Smoking

Smoking is the leading cause of preventable death in the United States. Best estimates suggest that smoking is responsible for over 18% of deaths (Mokdad, Marks, Stroup, & Gerberding, 2004; see also McGinnis & Foege, 1993). Smoking has been implicated in numerous health problems, including cancers (most notably lung cancer), cardiovascular disease, and pulmonary obstructive disease (Center for Disease Control [CDC], 2002). With recent studies estimating that more than 45 million adults

(approximately 21% of the adult population) in the U. S. currently smoke (Fiore et al., 2008), there is a significant public health impact.

In addition to mortality and morbidity, smoking is associated with numerous social and economic costs. Estimates of the cost of smoking-related illnesses in the U.S. range from $72.7 billion to $157 billion per year, including cost of health care for smoking related illnesses, as well as decreased productivity, work missed due to illness, and mortality (CDC, 2002; Fiore et al., 2008; Miller, Zhang, Rice, & Max, 1998). Looking just at health care costs, 12% of all health care costs were smoking-related (Miller et al., 1998; other estimates range from 6% to 14%; CDC 2002). Framed in another way, the total (direct and indirect) economic consequences of smoking are $3,331 per smoker, or $475 per person (including both smokers and nonsmokers), per year (Max, Rice, Sung, Zhang, & Miller, 2004). Smoking is not only a serious health risk for those who smoke, but also has a substantial social and economic impact.

Smoking Cessation Treatment

Nicotine, the active ingredient in tobacco products, is highly addictive. Since 1988, when then-Surgeon General C. Everett Koop issued a report stating that nicotine is just as addictive as heroin or cocaine, and calling for formal treatment programs, self-help materials, and nicotine replacement therapy to be made available to smokers who want to quit (Tolchin, 1998), considerable resources have been devoted to research and intervention to reduce the prevalence of smoking. Numerous interventions have targeted smoking behavior, particularly in the past 25 years. Smoking cessation programs, predominantly phone-based quit lines, which may include nicotine replacement therapy

(NRT) and phone-based behavioral counseling, are widely available, offered by many insurance companies, as well as funded by many states (Lichtenstein, Zhu, & Tedeschi, 2010), particularly for low-income populations who might otherwise be unable to afford services (Wadland, Soffelmayr, & Ives, 2001).

The great majority of these interventions, in line with the recommendations of the American Medical Association (e.g., Fiore et al., 2000), have focused either on changing the cognitions and behaviors associated with smoking (e.g., using cognitive behavioral or motivational interviewing strategies) or using nicotine replacement therapy (NRT; most commonly, the nicotine patch, gum, or lozenge). Increasingly, smokers who are quitting may have access to non-NRT medication options for treatment. Specifically, two non-NRT medications, buprioprion (Goldstein, 1998; Kotlyar, Golding, Hatsukami, & Jamerson, 2001) and varenicline (Garrison & Dugan, 2009), have been demonstrated to be effective and are considered appropriate first-line pharmacotherapy options for smoking cessation treatment (Fiore et al., 2008). Although there is generally consensus that these medications are associated with increased rates of cessation, especially early in the quitting process, it is still unclear by what mechanisms these medications promote cessation (e.g., via effects on neurotransmitters [noradrenaline], effects on stress-reactivity, etc.; Kotlyar et al., 2006). Current recommendations (Fiore et al., 2008) note that, separately, medication (NRT, buproprion, or varenicline) and counseling are effective treatments for smoking cessation, but conclude that the most effective treatments combine both medication and counseling interventions.

Relapse and Barriers to Maintaining Cessation

Despite the plethora of research aimed at increasing the efficacy of smoking cessation treatments, long-term quit rates for state-of-the-art treatments are relatively low, with 6-month cessation maintenance rates estimated at between 15 and 25 percent (Fiore, Hatsukami, & Baker, 2002). Although over time this has brought about a substantial reduction in the proportion of adults identifying as smokers (almost half of adults in the United States who ever smoked have quit), there are still more than 46 million adult smokers in the U.S. (CDC, 2001).

As implied in the often-quoted Mark Twain line "Giving up smoking is the easiest thing in the world. I know because I've done it thousands of times", a great many people do quit smoking only to relapse after a week or two of cessation efforts, while many others fail to refrain even for the week usually necessary to be considered as having quit. Because relapse is such a critical issue in smoking cessation, researchers (e.g., Piasecki, Fiore, McCarthy, & Baker, 2002) have argued for the importance of thinking critically and theoretically about relapse prevention. Particularly, Piasecki et al. emphasized that all interventions they studied (e.g., nicotine replacement therapy, behavioral intervention [individual counseling]) showed similar slopes of relapse in survival analysis (i.e., growth curve modeling of the dichotomous outcome of cessation or relapse).

Factors Associated with Smoking Lapse and Relapse

Several models for conceptualizing relapse or relapse prevention have been articulated in the broader addictions literature (e.g., Marlatt & Gordon, 1985; Marlatt & Witkiewitz, 2005; Tiffany, 1990; and from a more biological perspective, Kreek & Koob, 1998). There is consensus in most models that relapse is a complex phenomenon

involving multiple dynamic dimensions, spanning automatic as well as effortful

processes. Some of the key dimensions highlighted in different models include individual

differences in cognitive appraisal, motivational, social, and biological/genetic factors;

differences in situational factors (cue exposure, physiological activation/withdrawal

symptoms, social support, exposure to hassles and stressful life events); and differences

in behavior (prior behavior being a good predictor of future behavior). Addressing all of

these factors is well beyond the scope of the current project, but it is beneficial to keep

the broader context in mind before focusing more closely on particular elements.

Specifically focusing on modeling smoking cessation relapse, researchers (e.g.,

Piasecki et al., 2002; Shiffman et al., 1996) have organized risk factors for relapse to

smoking into two primary categories: 1) physiological withdrawal symptoms, and 2)

exposure to stress and cravings in stressful situations. Below, I discuss both of these

factors in relation to smoking, and argue that negative affect is an important contributor

to both of these relapse factors.

Withdrawal and smoking. There is ample evidence from clinical and controlled

lab studies that withdrawal is associated with relapse. Studies of NRT and pharmacology

for smoking cessation have demonstrated that medications reducing nicotine withdrawal

or treating withdrawal symptoms lead to increased odds of successfully quitting (Fiore et

al., 2008; Kotlyar et al., 2001; Garrison & Dugan, 2009). Similarly, smokers using NRT

plus counseling reported significantly fewer withdrawal symptoms than those receiving

only counseling (Cinciripini et al., 1996).

Further, nicotine withdrawal symptoms share considerable overlap with symptoms and experiences of negative affect (Carmody, Vieten, & Astin, 2007; Kreek & Koob, 1998; Tiffany, 1990). Though withdrawal may be in part physiologically determined, it is also influenced by perception. For example, smokers whose religious beliefs prohibit smoking at certain times report fewer cravings and withdrawal symptoms during those periods (e.g., orthodox Jews on the Sabbath; Dar, Stronguin, Marouani, Krupsky, & Frenk, 2005). Similarly, smokers who do not see themselves as addicted experience fewer cravings and withdrawal symptoms than do other smokers (Shiffman & Paty, 2006). These perceptions, as well as the similarity between physiological withdrawal and negative affect, suggest that in addition to traditional NRT or psychopharmacological approaches, both cognitive strategies (i.e., changing beliefs or expectancies about symptoms) and emotion regulation strategies (i.e., tools for regulating negative affect, not including smoking) may also be relevant in addressing withdrawal.

Stress and smoking. Converging findings from experimental, animal, and human correlational and intervention studies strongly demonstrate the association between stress and smoking. Overall, smokers report higher levels of stress than nonsmokers (Froelicher, Li, Mahrer-Imhof, Christopherson, & Stewart, 2004). Many smokers who relapse to smoking after a period of cessation attribute their relapse to stress (Pomerleau, Pomerleau, McPhee, & Morrell, 1990). Some studies have shown that physiological stress reactivity can predict likelihood of later relapse to smoking (Abrams et al., 1987; Calhoun, Dennis, & Beckham, 2007). Please see Appendix C for a more detailed empirical review of stress and smoking.

Negative affect: The common link between withdrawal- and stress-related urges. The findings described above highlight the importance of perceptual factors related to withdrawal and stress in understanding urges to smoke. Smokers often may fail to distinguish withdrawal-related symptoms from situational or stress-related symptoms. As Tiffany (1990, p. 149) stated: "physiological sensations other than withdrawal might be misattributed to a desire to use drug [sic], or withdrawal sensations, under some circumstances, may not be identified by the addict as urges and cravings," noting that this misattribution as to the cause of the physiological and affective experiences is a variant on Schacter and Singer's (1962) two-factor theory of emotion. Research supports this idea, including one study showing that smoking relieves negative affect due to physiological withdrawal but not negative affect in the absence of nicotine withdrawal (Perkins, Karelitz, Conklin, Sayette, & Giegowd, 2010). Overall, there is ample evidence to suggest that affective experiences, particularly negative affect, are implicated in maintaining smoking behavior. Please see Appendix D for a more detailed empirical review of negative affect and smoking.

Expectancies for negative affect reduction. Despite the evidence to the contrary, many smokers persist in the belief that smoking will reduce negative affect. Expectancies for negative affect reduction have been shown to be positively related to amount smoked, as well as urges to smoke within the context of nicotine withdrawal (Brandon & Baker, 1991; Brandon, Wetter, & Baker, 1996). Brandon and colleagues have found that expectancies that smoking will relieve negative mood were associated with cravings to smoke and actual smoking behavior among smokers who abstained for

one week. Expectancies for mood regulation have also been shown to be an important predictor of smoking in smokers with other comorbidities (e.g., depressed, alcoholic smokers; Currie, Hodgins, el-Guebaly, & Campbell, 2001). In the related domain of alcohol use, Cooper and colleagues (1995) reported that mood regulation expectancies (e.g., beliefs about enhancing positive mood or reducing negative mood by drinking) predicted drinking behavior better than actual measures of mood.

One of the critical components to note in these findings is that the construct in question is the individual's perception or *expectation* that smoking or drinking will serve to regulate his or her mood. Where measured, despite expectancies, these behavioral indulgences are not typically effective in actually reducing negative mood (e.g., Tice et al., 2001). Overall, the findings suggest that what looks like behavioral self-regulatory failure may actually be an ineffective yet logical attempt at engaging in emotional self-regulation, which has taken priority over behavioral regulation.

Emotion Regulation: Strategies for Coping with Negative Affect

Benefits of emotion regulation for smoking outcomes. Effective coping has been shown to reduce cravings or temptations to smoke. Different coping styles have been differentially associated with quitting smoking. In a longitudinal cessation study, smokers who reported more problem-focused coping were more likely to remain quit, whereas smokers who reported more emotion-focused coping were more likely to relapse (Wewers, 1988). Other findings on the association between coping and smoking are mixed. Negative affect regulation has predicted maintenance of cessation once quit, but not initial cessation (Kamarck & Lichtenstein, 1988). Coping with negative affect has

been considered a particularly critical dimension of coping relevant to smoking cessation. For example, experimental work comparing quitters and relapsers suggested that quitters are more effective in coping with negative mood and anxiety in response to a stressful task (Abrams et al., 1987).

In the only field study of its kind of which I am aware, resource depletion predictions were tested in a group of smokers currently engaged in cessation (O'Connell et al., 2008). Contrary to predictions of a limited resource model, having recently successfully resisted more temptations to smoke was associated with better outcomes (e.g., lower risk of lapse or relapse at follow-up). Similarly, practicing self-control has been shown to actually increase positive outcomes over longer periods of time. An intervention study (Muraven, 2010) showed that smokers who practiced behavioral self-control for two weeks prior to quitting smoking demonstrated increased ability to resist smoking for one month, independent of expectancies that practice will help. Interestingly, this beneficial effect of practicing self-control occurred despite participants practicing different self-control behaviors (e.g., grip-strength or resisting eating sweets) than the measured target self-control behavior outcome of quitting smoking, suggesting that the act of practicing behavioral self-control confers benefits that are transferrable across behavioral domains.

Does coping increase the likelihood of smoking? However, a number of lab-based studies have found that smoking and cravings to smoke are affected by previous completion of other depleting tasks requiring self-control and persistence. Smokers who had to resist tempting snacks (compared to healthy ones) were significantly more likely

to smoke during a lab session break (Schmueli & Prochaska, 2009). Similarly, smokers who were asked to keep an arm submerged in ice cold water, which is a painful task that required significant self-regulatory effort, subsequently reported stronger urges to smoke and were quicker to light up (Ditre & Brandon, 2008).

In summary, there is ongoing debate as to whether emotion regulation facilitates or impairs behavioral self-regulation (e.g., Aldao et al., 2010). In accounting for the conflicting theories and findings, it is useful to organize findings according to factors that may help clarify which types of emotion regulation are helpful, under which circumstances. The following review of the literature focuses on experimental studies of three types of emotion regulation strategies – suppression, cognitive reappraisal, and mindfulness/acceptance – and their effects on smoking urges and behavior. Where such results were not available, correlational findings and results from similar related behavioral outcomes (e.g., alcohol use) were reviewed.

Outcomes Associated with Suppression, Reappraisal, and Acceptance

Smoking and emotional suppression. Emotional suppression has been associated with poorer behavioral self-regulation in several domains, and researchers (Carmody et al., 2007) have highlighted the similarity to findings that avoidance helps maintain anxiety (e.g., Barlow, 1993). Additionally, there is evidence that suppression of smoking-related thoughts is associated with lower levels of self-efficacy to refrain from smoking (though not actual smoking behavior; see Litvin, Kovacs, Hayes, & Brandon, 2012). Others (e.g., Sayette, 2004; Tice et al., 2001) have suggested that smokers would experience the same type of impairment in behavioral self-regulation following emotional

self-regulation (suppression). The most relevant test of this hypothesis examined the relation between trait suppression and urges to smoke and smoking (Fucito, Juliano, & Toll, 2010). Specifically, they found that people high in trait suppression displayed more interference from smoking cues on a cognitive task (smoking Stroop), as well as shorter latency to smoking.

Cognitive reappraisal and smoking. Cognitive reappraisal strategies generally have been shown to be associated with lower levels of cravings to smoke. A temporal cognitive reappraisal manipulation predicted food cravings and smoking cravings, such that participants who were instructed to think about the long-term outcomes of smoking had lower cravings than those who were instructed to think about the short-term outcomes of smoking (Kober, Kross, Mischel, Hart, & Ochsner, 2010). These findings are consistent with Gross and John's (2003) emotion regulation model, in which cognitive reappraisal is associated with better behavioral outcomes, and with work (e.g., Salovey et al., 1999) on the effect of different temporal perspectives on behavioral self-control. In another study, an interaction was found between an experimental mood induction (positive or negative) and cognitive coping skills in predicting cravings to smoke, such that people with both low positive mood and low levels of positive cognitive coping skills were at increased risk for higher urges to smoke (Rabois & Haaga, 2003).

Comparison of suppression and reappraisal. There are only three studies of which I am aware that compare two emotion regulation strategies in smokers, and only one of these examines smoking outcomes in a controlled experimental design. In a lab study on the effects of habituation or trait emotion regulation strategies on smoking,

Fucito and colleagues (2010) found that, following a negative mood induction, people higher in trait reappraisal smoked fewer cigarettes per day overall, and had lower expectancies that smoking would improve mood. Additionally, people higher in trait suppression displayed more interference from smoking cues on a cognitive task (smoking Stroop), but neither trait reappraisal nor trait suppression were associated with smoking urges during the lab study.

In another study (Piper & Curtin, 2006), participants were instructed to suppress, maintain, or enhance their emotional response to negative stimuli. However, the focus on this study was on differences in startle response across emotion regulations. They proposed an interaction between emotion regulation strategy condition and state of withdrawal from smoking, but found no differences between current smokers, withdrawn smokers, and nonsmokers in their ability to regulate emotion (suppress, maintain, or enhance) during exposure to unpleasant stimuli. These findings speak more to the ability of smokers to engage in emotion regulation under controlled conditions than to any differences in the efficacy of different emotion regulation strategies.

Lastly, there is also evidence from a third correlational study (Magar, Phillips, & Hosie, 2008) to suggest that smokers report lower levels of reappraisal than do nonsmokers. However, no differences in suppression were observed between smokers and nonsmokers. Further, higher reappraisal scores were associated with later onset of smoking, whereas earlier age at smoking initiation was association with higher suppression scores.

Mindfulness, acceptance, and smoking. Acceptance and mindfulness have become increasingly popular in psychological interventions in recent years. Therapies such as Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn et al., 1992), Dialectical Behavior Therapy (DBT; Linehan, 1993), and Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999) are part of the third wave of behavioral therapies. Mindfulness techniques involve learning to focus attention, observing without judging, accepting things as they are, and differentiating observations from thoughts and feelings. These third-wave therapies have become standard evidence-based fare for a number of different mental health diagnoses. As yet, however, there is still limited application of these models to the study of health behaviors.

Little experimental work has been done in the area of mindfulness or acceptance and smoking, though as previously noted, Carmody and colleagues (2007) highlighted this as a promising area for smoking cessation intervention and relapse prevention. Preliminary studies of the effects of mindfulness meditation on other substance abuse suggest that mindfulness may be helpful in relapse prevention (Marlatt & Witkiewitz, 2005; Vieten, Astin, Buscemi, & Galloway, 2010). Similarly, empirical findings from a pilot study of an acceptance-based intervention for smoking cessation appear promising (Gifford et al., 2004). In a prospective smoking study, smokers who were lower in mindfulness were more highly addicted, had more withdrawal symptoms and lower self-efficacy for refraining from smoking (Vidrine et al., 2009). Difficulty in distress tolerance (the converse of acceptance-based emotion regulation) is also significantly more common in smokers who have never been able to sustain a quit, based on responses

to physical and psychosocial stressor challenges in a lab-based study comparing immediate relapsers (relapsed within 24 hours) and delayed relapsers (Brown, Lejuez, Kahler, & Strong, 2002). In one study of mindfulness and smoking (Gonzalez, Vujanovic, Johnson, Leyro, & Zvolensky, 2009), mindfulness was related to expectancies for mood regulation, with greater mindfulness associated with lower levels of expectancies for negative mood regulation. No experimental lab studies of mindfulness as an emotion regulation strategy for smokers and no comparisons of mindfulness skills between smokers and nonsmokers were identified.

Summary and Limitations of the Current Literature

Emotion regulation is a key aspect of coping (Skinner et al., 2003), and one that has been highlighted as being of particular relevance for smoking cessation. The study of emotion regulation processes in smoking behavior is a growing area, with thoughtful theoretical explorations (e.g., Carmody et al., 2007; Carmody, 1989), but still a limited number of empirical studies. Emotion regulation may be implicated in short-term effects related to smoking initiation and sustaining cessation over a brief period of time as well as longer-term maintenance processes.

Previous research has firmly established the association between stress and smoking. Smokers who report more stress are less likely to successfully quit or maintain cessation. Research has also linked negative affect with smoking and with difficulty quitting. The majority of the studies examining coping in the context of smoking specifically focus on coping with smoking-related stressors (e.g., with cravings to smoke;

Abrams et al., 1988) or coping with lapses (e.g., abstinence violation effect [AVE]; Curry

et al., 1987) which are important, but very different questions than the present inquiry.

Studies of the effects of coping on smoking cessation show promising yet mixed

results (Abrams et al., 1987; Haaga et al., 2004; Kober et al., 2010; Shadel &

Mermelstein, 1993; Wewers, 1988). Similarly, research has shown that compared to

nonsmokers, smokers report higher levels of stress coupled with lower levels of coping

skills and resources (e.g., Billings & Moos, 1983; Magar et al., 2008). Engaging in

effective coping behavior (particularly cognitive reappraisal and problem-focused

coping) appears to reduce distress and be associated with greater likelihood of cessation

for people exposed to stressors (e.g., Haaga et al., 2004; Kober et al., 2010). Thus,

examination of the types of emotion regulation strategies smokers naturally use is

warranted.

Purpose of the study[2]

As a first step in exploring the role of emotion regulation in smoking maintenance

and cessation, the current study compares individual differences in emotional distress and

emotion regulation strategies between daily smokers and nonsmokers. Some laboratory

studies have shown that at least one type of emotion regulation, suppression, is associated

with poorer behavioral self-regulation for smokers. Others suggest that some types of

---

[2] The original intent of this study was to conduct a laboratory study manipulating emotion regulation strategies in smokers who had already completed questionnaires documenting baseline levels of distress, negative affect, and various emotion regulation strategies. Unfortunately, despite significant efforts by the research team, insufficient participants were retained through the laboratory portion of the study. The revised purpose and analytic plan, described in the text, makes use of the baseline questionnaires completed by participants. Please see Appendix E for additional details about the original aims of the study and recruitment efforts.

self-regulation, such as cognitive reappraisal, appear to improve other behavioral self-regulation outcomes for smokers. However, though these studies examined the impact of different emotion regulation styles within smokers, there are few existing direct comparison of the emotion regulation approaches of smokers and nonsmokers (but see Magar et al., 2008 for a comparison of suppression and reappraisal between smokers and nonsmokers). Thus, the purpose of the current study is to begin to address the question of how smokers differ from nonsmokers in different types of emotion regulation, and set the stage for future lab-based and clinical intervention studies of emotion regulation and smoking maintenance and cessation. Additionally, the study aimed to examine the relations between smoking behavior on the one hand and negative affect and emotion regulation strategies on the other.

Method

Participants

Recruitment. Participants were drawn from a broader study[3], recruited from students enrolled in psychology courses at the University of Minnesota as well as from the broader community. Requirements for participation included being 18 years of age or older, and being a daily smoker (defined as smoking at least one cigarette every day). Many college students (late adolescents and young adults), compared to adult smokers, smoke fewer cigarettes per day (< 10 cpd) or smoke less frequently (i.e., do not smoke daily), yet still display similar levels of addiction and similar or only slightly higher rates

---

[3] As noted in footnote 2, participants were initially recruited for a two-part study. Due to difficulties with retention to the second part of study (see Figure 9 for participants attrition information), the data presented here include all participants with sufficiently complete data from the initial online questionnaire.

of quitting as older daily smokers (see Mermelstein, 2003; Rabius, Geiger, McAlister, Huang, & Todd, 2004) and similar patterns of association between negative affect and smoking (Lumley, Downey, Stettner, Wehmer, & Pomerleau, 1994). By incorporating participants who smoke at lower levels, this study allowed for extension of previous findings about emotion regulation and smoking to a potentially similarly addicted but less frequent group of smokers, as well as testing additional emotion regulation strategies.

Based on information from the Minnesota College Health Surveys (Lust, Ehlinger, & Golden, 2006, 2010), in recent years, between 2% and 5% of students at the University of Minnesota report smoking daily. In contrast, state public health data (Minnesota Department of Health, 2011) show that a substantially higher proportion (16.1%) of adult Minnesotans are current smokers, with young adults ages 18-24 reporting even higher rates (21.8%). Thus, to obtain a large enough sample of daily smokers, participants were recruited through posters and cards handed out in the local community, as well as on campus. Recruiting participants who smoke daily (rather than intermittently) allowed the study to be conducted in a sample of more frequent, more addicted regular smokers, increasing the external validity (generalizability to clinical interventions). Participants were told that the study concerned how smoking affects how people think and feel, and were initially screened via email contact to ensure they met smoking criteria for the study. Participants received their choice of either course credit or $15 cash compensation for their participation in the study.

Demographics. In this sample ($N = 99$), 47.5% identified as female, 38.4% identified as male, and 14.1% did not disclose. The majority (55.6%) identified as

European American, with others identifying as Asian/Asian American (14.1%), African/ African American/Black (7.1%), Native American (4.0%), Middle Eastern/Arab American (2.0%), Hispanic/Latino(a)/Mexican American (1.0%), and Bi-/Multi- Racial (3.0%). A number of participants (13.1%) did not disclose ethnic identification. The greatest proportion of participants was between the ages of 18-21 (32.3%), followed by those between ages 22-25 (18.2%), ages 26-29 (13.1%), ages 30-33 (9.0%), ages 34-45 (6.0%), and above age 45 (7.1%). A number of participants (14.1%) did not report their age.

Comparison of smokers and nonsmokers. A number of analyses reported below compared smokers ($n = 99$) with nonsmokers ($n = 114$) from sample previously described in Study 1. Smokers were on average a bit older than nonsmokers, though the majority of both samples were under age 25. Additionally, more participants in the nonsmoking sample were female or Asian than in the smoking sample. Lastly, all participants in the nonsmoking sample were recruited from undergraduate psychology courses. However, as anticipated due to the low rate of daily smoking in the student population, only 22.2% were recruited from undergraduate psychology courses, and another 23.2% of the smoking sample was comprised of other university students across campus. The majority of participants (54.6%) were recruited from the community. See Table 20 for a more detailed comparison of the samples.

Procedure

All participants who met criteria as a daily smoker were provided with a link and a one-time passcode for the secure online questionnaire. Participants read a consent form

as the first screen of the computer-based assessment, and gave consent by clicking a button stating, "I have read the above consent form and agree to participate in this study." Names and contact information were recorded separate from other data provided by the participants, solely for the purpose of ensuring that participants received the appropriate compensation for their participation. Participants were asked to report demographic variables, several measures of emotion regulation, perceived stress, depression, anxiety and stress, positive and negative affect, and mindfulness. Participants were also asked to report current and historical smoking, including current cigarettes per day, age on initiation, longest period without smoking, cravings to smoke, and expectancies for smoking.

Measures

In addition to basic demographic information (age, gender, ethnicity), participants were asked to complete the following assessments via an online questionnaire.

Measures of smoking behavior and dependence.

History and current smoking information. Participants were asked to report the number of cigarettes smoked per day over the past 6 months, age of smoking initiation, and length of longest quit (if any). Additionally, they were asked about other smokers in their lives, including friends, partners, and others living in the same household.

Fagerström Test for Nicotine Dependence (FTND; Heatherton, Koslowski, Frecker, & Fagerström, 1991). This widely used 6-item revised version of the original Fagerström Tolerance Questionnaire (Fagerström, 1978) measures nicotine dependence through responses to questions such as *How soon after you wake up do you smoke your*

first cigarette? (Higher scores given for smoking more rapidly upon waking). Total

nicotine dependence scores range from 0 to 10. Scores lower than 4 indicate low to

moderate addiction, 4-6 indicates low to moderate addiction but more likely to

experience physiological withdrawal upon cessation, and 6-10 indicates high

physiological dependence. The FTND has been well-validated, and in this sample, scores

showed internal consistency reliability ($\alpha = .69$) similar to that found in other samples

(e.g., Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994),

  Smoking Consequences Questionnaire. The Smoking Consequences

Questionnaire (SCQ; Brandon & Baker, 1991) measures beliefs and expectancies about

smoking consequences. Only the two domains (positive reinforcement/sensory

satisfaction [SCQ-PA] and negative reinforcement/negative affect reduction [SCQ-NA])

relevant for this study were completed. Sample items included *If I'm tense, a cigarette*

helps me to relax (SCQ-NA) and *I really enjoy a cigarette when I'm relaxed and feeling*

good (SCQ-PA). Participants responded to each of the 27 items (15 on the SCQ-PA and

12 on the SCQ-NA) on a scale from *extremely unlikely* (0) to *extremely likely* (9). Scores

on the SCQ-NA ($\alpha = .95$) and SCQ-PA ($\alpha = .91$) scales both showed internal consistency

reliability in this sample.

  Cravings to smoke. Participants were asked to report their urges to smoke in a

variety of situations, using a composite measure used in previous studies (e.g., Baldwin et

al., 2006) based on other measures of smoking cessation self-efficacy (Colleti, Supnick,

& Payne, 1985; Condiotte & Lichtenstein, 1981; Etter et al., 2000; Gwaltney et al., 2005;

Velicer et al., 1990). Responses were measured using a 5-point scale from *not at all*

tempted (0) to *very tempted* (4) scale. Temptation ratings were provided only for situations experienced during the past week. Scores on this measure showed internal consistency reliability in this sample (α = .84).

Measures of Affect and Stress.

Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The well-validated PANAS (described in more detail in study 1) was used to measure trait levels of positive and negative affectivity. Scores on both the PA (α = .83) and NA (α = .90) scales showed internal consistency reliability in this sample.

Perceived Stress Scale. Participants completed the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), described in more detail in Study 1. Internal consistency reliability for scores in this sample was α = .83.

Depression Anxiety Stress Scale. Participants completed the Depression Anxiety Stress Scale-21 (DASS; Lovibond & Lovibond, 1995), described in more detail in Study 1. In this sample, internal consistency reliability for the full scale scores was α = .93; all subscale reliabilities ranged from .80 to .88.

Measures of emotion regulation.

Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). Described in more detail in Study 1, the ERQ is one of the most well-validated and commonly used measured of emotion regulation. In this sample, scores on both the cognitive reappraisal (α = .86) and suppression (α = .80) scales showed internal consistency reliability.

Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). The DERS is a multidimensional scale of emotion regulation (also described in more detail in Study 1). Scores showed internal consistency reliability in this sample for the full scale DERS ($\alpha = .93$) and all subscales (ranging from .79 to .94).

Negative Mood Regulation (NMR; Catanzaro & Mearns, 1990). Scores on the NMR (described in more detail in Study 1) showed internal consistency reliability ($\alpha = .92$) in this sample.

Mindfulness. The Mindful Attention and Awareness Scale (MAAS; Brown & Ryan, 2003) described more thoroughly in Study 1, was used to measure mindfulness skills. Scores on this scale demonstrated internal consistency reliability in this sample, with Cronbach's alpha of .92.

Revised Analytic Plan

Because there was insufficient sample size in the planned laboratory follow-up to conduct the intended analyses, I reviewed variables from the online questionnaire and developed a new analytic plan. The revised analytic plan, while not testing the original hypotheses (see Appendix F for details), does address some questions of interest. In addition to exploring the basic profile of the smokers in this study (demographics, smoking history, level of addiction), I was also interested in comparing the smokers in this study (Study 2) with the (almost exclusively) nonsmokers[4] in the eating study (Study 1). I predicted that compared to the nonsmokers, the smokers would report higher

---

[4] There are no smoking data in Study 1- Eating & ER, so the smoking status of individual participants in Study 1 cannot be verified; however, from other studies in this same population (e.g., Frazier et al., 2009), fewer than 3% of undergraduate psychology students at the University of Minnesota are regular smokers.

baseline levels of distress, anxiety, and negative affect. Secondly, I predicted that

compared to the nonsmokers, the smokers would have poorer emotion regulation skills.

Finally, I predicted an association between expectancies that smoking would reduce

negative affect and other variables (smoking-related and emotion-regulation measures).

Hypothesis 1. Smokers will be more distressed than nonsmokers. Compared

to the nonsmokers, I predicted that the smokers would report higher baseline levels of

stress (PSS), depression/anxiety/stress (DASS), and negative affect PANAS-NA. I also

predicted that smokers would report lower levels of positive affect (PANAS-PA). To test

this hypothesis, data from Study 1 (Eating and Emotion Regulation) were merged with

data from Study 2 (Smoking and Emotion Regulation). Because the PSS, DASS, and

PANAS-NA scores were both conceptually and statistically related (r's ranged from .57 -

.61), a MANOVA was conducted to compare mean levels of stress, depression, anxiety,

and negative affect between smokers and nonsmokers. A separate independent samples t-

test was conducted to compare mean levels of positive affect (which was neither

theoretically nor statistically related to other affect variables) between smokers and

nonsmokers.

Hypothesis 2. Smokers will have poorer emotion regulation skills. Compared

to the nonsmokers, the smokers should have poorer emotion regulation skills.

Specifically, I predicted that smokers would report higher levels of trait suppression

(ERQ-S) and difficulty regulating negative emotions (DERS). I also predicted that

smokers would report lower levels of trait cognitive reappraisal (ERQ-CR), skill in

regulating negative mood (NMR), and mindfulness skills (MAAS). Testing this

hypothesis also required merging the data from Studies 1 and 2. Because the NMR, ERQ-CR, and MAAS are all measures of positive emotion regulation strategies, and because they were all at least modestly correlated (r's ranged from .28 - .52), a MANOVA was conducted to compare mean levels of negative mood regulation skills, cognitive reappraisal, and mindfulness between smokers and nonsmokers. Separate independent samples t-tests were conducted to compare mean levels of suppression and difficulty regulating emotion, because the ERQ-S and the DERS do not measure positive emotion regulation skills and were not significantly positively correlated with other emotion regulation measures in either sample.

Hypothesis 3. Expecting that smoking will reduce negative affect will be associated with more smoking and urges to smoke. Smokers who have higher expectations that smoking will reduce negative affect were expected to be more addicted, smoke more, and report higher levels of cravings to smoke across situations. Consistent with previous research with the SCQ (Brandon & Baker, 1991) I predicted a positive correlation between expectancies that smoking will reduce negative affect (SCQ-NA) and level of addiction (FTND) and a positive correlation between expectancies that smoking will reduce negative affect (SCQ-NA) and amount smoked (cigarettes per day). I also predicted either a small positive or no correlation between expectancies that smoking will reduce negative affect (SCQ-NA) and years smoked. Additionally, I predicted a positive correlation between expectancies that smoking will reduce negative affect (SCQ-NA) and cravings to smoke across situations, but particularly within situations that elicit negative affect. Previous research (e.g., Brandon et al., 1994) has produced mixed results, showing

associations with a three-item general urges measure only for smokers currently in withdrawal, but I predicted that with the more detailed measure of urges used in the current study, there would be an association regardless of recency of last cigarette. To test these hypotheses, only the data from Study 2 were required. Pearson correlations were conducted between the variables as specified.

Hypothesis 4. Expecting that smoking will reduce negative affect will be associated with poorer emotion regulation skills. Smokers who have higher expectations that smoking will reduce negative affect should report more difficulty with emotion regulation and have poorer emotion regulation skills. I predicted a positive correlation between expectancies that smoking will reduce negative affect (SCQ-NA) and trait suppression (ERQ-S), and a negative correlation between expectancies that smoking will reduce negative affect (SCQ-NA) and trait cognitive reappraisal (ERQ-CR). I also predicted a positive correlation between expectancies that smoking will reduce negative affect (SCQ-NA) and difficulty with emotion regulation (DERS). Finally, I predicted negative correlations between expectancies that smoking will reduce negative affect (SCQ-NA) and both skills for negative mood regulation (NMR) and mindfulness (MAAS). To test these hypotheses, only the data from Study 2 were required. Pearson correlations were conducted between the variables as specified.

Results

Data Cleaning

None of the affective (PANAS, PSS, DASS) or emotion regulation (ERQ, NMR, DERS, TEARS, MAAS) measures were significantly skewed (i.e., all skew values were

within +/- 1). Similarly, none of the smoking measures (SCQ-NA, FTND, Cravings) were significantly skewed. Additionally, as advocated by Tabachnick and Fidell (2007), I analyzed for univariate outliers for all variables. Only one case was identified as a univariate outlier for two variables (DASS and NMR). Inclusion or exclusion of this case made no difference in the result of any of the analyses.

Smoking History

Given that this study drew participants from a student as well as community population, examination of current smoking behavior and smoking history was particularly important. It was expected that participants would smoke much less than a pack per day, for two reasons. First, there is evidence to suggest that teens and young adult smokers on average smoke less than their older counterparts, though the younger smokers may be similarly addicted and still have difficulty with cessation (Mermelstein, 2003). Secondly, epidemiological research (e.g., O'Connor et al., 2008) suggests that overall, smokers in the U.S. currently smoke fewer cigarettes per day (cpd) than a few decades ago, with the decrease predominantly due to decreases in the low (less than 10 cpd) and high (more than 20 cpd) level smokers.

Participants in the current sample reported smoking an average of about half a pack per day, ($M = 9.02$ cpd, $SD = 6.19$, $Mdn = 7.00$), ranging from 2 cpd to a pack and a half (30 cpd) per day. Self-reported smoking history has been shown to be reliable in multi-method studies (e.g., Soulakova, Hartman, Liu, Willis, & Augustine, 2012). Even though this sample skewed younger than some studies of smokers, participants reported

they had on average smoked regularly for approximately 9 years ($M = 9.14$, $SD = 9.35$,

$Mdn = 6.17$), ranging from 2 months to 46 years.

A majority (61.6%) of participants reported they had intentionally quit smoking

for one day or more in the past 12 months. The great majority (75.8%) reported having

cut down their highest level of smoking (i.e., currently smoking fewer cpd). Still, despite

these efforts, some participants (8.1%) reported they were unable to go 24 hours without

a cigarette. More than a quarter (28.3%) reported their efforts at cessation were unable to

last a week, while nearly another quarter (22.2%) were able to sustain a quit longer than a

week, but less than a month. A third of participants (34.3%) reported successfully

quitting for more than a month, but relapsing in less than a year. Very few participants

(7.1%) reported having successfully maintained a quit for more than one year.

Another factor affecting smoking behavior is living with or spending time with

other smokers. In this sample, half (50.5%) of participants reported currently living with

another smoker. Of those who shared a household with another smoker, most often the

other smoker was not a spouse or partner; only a third (32.0%) of those who lived with

another smoker reported having a spouse or partner who smoked. However, the majority

(63.6%) of participants reported that half or more of their friends smoked, which speaks

to the importance of examining the role of social dynamics in the initiation, maintenance,

and cessation of smoking.

Participants completed the Fagertröm (FTND; Heatherton et al., 1991), a well-

established measure of level of addiction. In interpreting the FTND, higher scores

indicate more addiction, with 5 or more as a typical marker of more severe level of

addiction. This sample overall skewed less addicted, with only approximately one fifth of

participants scoring 5 or higher, and one fourth scoring zero. One factor in this may be

that younger smokers may have different patterns of smoking (e.g., fewer cpd, smoking

more in the evening than in the morning) yet still have similar difficulties with cessation.

Other studies (e.g., Haddock, Lando, Klesges, Talcott, & Renaud, 1999) have found that

some of the Fagerstrom items may have less utility for discriminating dependence in

younger or lower level smokers.

Affective Profiles of Smokers and Nonsmokers

Smokers on average were more stressed and anxious, and had more negative

mood than nonsmokers (see Table 21), Wilks' Lamda = .900. $F(3, 204) = 7.59$, p < .001,

$\eta_p^2 = .100$. Smokers had significantly higher levels of perceived stress (PSS) than

nonsmokers, $F(1, 206) = 12.60, p < .001, \eta_p^2 = .058, d = .51$, as well as significantly

higher levels of overall distress (depression, anxiety, and stress on DASS), $F(1, 206) =$

$21.78, p < .001, \eta_p^2 = .096, d = .59$ (see Figure 10). Similarly, smokers endorsed higher

levels of negative affect (PANAS-NA), $F(1, 206) = 14.65, p < .001, \eta_p^2 = .066, d = .50$

(see Figure 11). There was no observed difference in positive affectivity (PANAS-PA),

$t(207) = .26, p =.80, ns.$

Emotion Regulation Profiles of Smokers and Nonsmokers

Compared to nonsmokers, smokers on average had significantly lower levels of

positive emotion regulation skills, Wilks' Lamda = .938. $F(3, 194) = 4.25, p < .01, \eta_p^2 =$

.062. Specifically, smokers endorsed lower levels of cognitive reappraisal (ERQ-CR),

$F(1, 196) = 9.04, p = .003, \eta_p^2 = .044, d = .42$ and significantly lower skills for regulating

negative emotions (NMR), $F(1, 196) = 9.99$, $p = .002$, $\eta_p^2 = .048$, $d = .43$ (see Figure 12).

In addition, smokers reported marginally significantly lower levels of mindfulness, $F(1, 196) = 3.43$, $p = .07$, $\eta_p^2 = .017$, $d = .30$ (see Figure 13).

Smokers also acknowledged that they had more difficulty with emotion regulation and relied more heavily on emotion regulation strategies that are ineffective. Smokers reported higher levels of trait emotional suppression (ERQ-S), an emotion regulation strategy previously associated with negative emotional and behavioral consequences, $t(207) = -2.70$, $p < .01$, $d = .37$ (see Figure 14). Overall, smokers also endorsed significantly more difficulty with emotion regulation (DERS), $t(207) = -3.12$, $p < .01$, $d = .42$.

Expectancies that Smoking Will Reduce Negative Affect: Associations with Smoking Behavior

I predicted that people who believe that smoking will help reduce negative affect (high scores on the SCQ-NA; Brandon & Baker, 1991) would smoke more, be more addicted, and have more cravings to smoke, particularly in intra- or interpersonal situations producing negative affect. Analyses were conducted with Pearson correlations, as all variables were continuous measures. The results overall supported these hypotheses. In terms of addiction, smokers who reported higher expectations that smoking would reduce negative affect were marginally more addicted (higher FTND scores), $r(97) = .19$, $p = .06$. Smokers who expected smoking to reduce negative affect also smoked significantly more cigarettes per day, $r(96) = .24$, $p < .05$. As well, smokers with higher expectancies that smoking would reduce negative affect reported

significantly higher levels of cravings across all situations, $r(97) = .51$, $p < .001$, and this effect was slightly stronger when looking at cravings in only negative affect situations, $r(97) = .56$, $p < .001$. In contrast, the correlation between expectancy that smoking will reduce negative affect and cravings in positive affect situations was $r(97) = .28$, $p < .01$. As expected, using a Fischer's r to z transformation, there was a significant difference in the predicted direction between the associations with urges in NA versus PA situations, $z = 2.37$, $p < .01$. There was no reason to think that older vs. younger smokers would significantly differ in their expectations that smoking would reduce negative affect; as predicted, there was no association between expectancies for NA reduction and number of years smoked.

NA Reduction Expectancies and Associations with Emotion Regulation Strategies

I predicted that people who expect that smoking will reduce negative affect would have more difficulty with regulating negative emotions, would rely more on emotional suppression, and would have fewer healthier emotion regulation strategies at their disposal.

Results were mixed with regard to these hypotheses. The data did support the predictions regarding difficulty regulating negative emotions and relying on suppression tactics. Smokers who had higher expectations that smoking would reduce negative affect did indeed report significantly more difficulty with emotion regulation (DERS), $r(95) = .36$, $p < .001$ and lower levels of ability to regulate negative mood (NMR), $r(91) = -.23$, $p < .05$. They also reported significantly higher levels of emotional suppression (ERQ-S), $r(96) = .33$, $p < .001$.

The data, however, did not support the hypothesis about lower levels of beneficial emotion regulation skills. Expectancies that smoking will reduce negative affect were unassociated with both cognitive reappraisal (ERQ-CR), $r(96) = .07$, $p = .52$, and mindfulness (MAAS), $r(87) = -.07$, $p = .49$.

Discussion

Overall, these survey data of a population of moderate daily smokers provide support for the hypothesis that emotion regulation is implicated in the maintenance of cigarette smoking. Differences between smokers and nonsmokers in emotion regulation skills and affective profiles suggest that this area is ripe for additional research and intervention. Similarly, the results show the importance of assessing and addressing smokers' expectancies that smoking will reduce negative affect.

Smokers are More Stressed and Unhappy than Nonsmokers

Overall, in the sample, compared to nonsmokers, smokers were more stressed, anxious, and depressed, which is in line with the findings of others (Calhoun et al., 2007; Froelicher et al., 2004). Smokers also reported higher levels of trait negative affectivity than did nonsmokers. These findings are consistent with the literature on negative affect and smoking, which overall suggests that smokers report higher levels of negative affect than nonsmokers (e.g., Kassel et al., 2007; Shiffman et al., 2005).

Smokers have Poorer Emotion Regulation Skills than Nonsmokers

The data show that difficulty regulating negative emotions and the use of emotional suppression are significantly higher in smokers than nonsmokers. The current results contribute to understanding of the mechanisms by which poor emotion regulation

or emotional suppression are related to global health outcomes. Specifically, people who have difficulty regulating emotions and rely on suppression of emotions as a strategy may increase their long-term health risks for cardiovascular and other diseases via engagement in risky behaviors such as smoking cigarettes. Prior to the current study, there had been limited evidence to suggest that, as a whole, populations who engage in risky health behaviors such as smoking have overall deficits in emotion regulation. One other study of emotion regulation skills (ERQ-S and ERQ-CR) shows higher rates of smoking in people lower in reappraisal but no relation with suppression (Magar et al., 2008). In contrast, the current results show an increased reliance on suppression in smokers, but no differences in reappraisal between smokers and nonsmokers.

The current findings are, however, consistent with the substantial converging evidence in the emotion regulation literature documenting that certain emotion regulation strategies are associated with situationally poorer enactment of behavioral self-control in several domains of health behaviors. For example, in lab studies, use of emotional suppression resulted in greater consumption of snack foods (Evers et al., 2010) and reduced latency to smoking among a group of smokers (Fucito et al., 2010).

There is also a body of literature demonstrating associations between emotional suppression or emotion inhibition and poorer long-term health outcomes. For example, Mauss and Gross (2004) reviewed a number of direct and indirect pathways through which suppression (particularly in conjunction with negative affect) can lead to poorer cardiovascular health. Others have noted that suppression of thoughts or emotions can

have an immunosuppressive effect (e.g., Petrie, Booth, & Pennebaker, 1998; Scheier &

Bridges, 1995).

Recently, there has been an upsurge of interest in the application of mindfulness

or acceptance strategies to health behaviors (e.g., Witkiewitz, Bowen, Douglas, & Hsu,

2013). The results of the current study showing lower levels of mindfulness skills in

smokers is congruent with the findings of Vidrine et al. (2009), who found that lower

levels of mindfulness were associated with vulnerability to relapse among smokers.

Negative Affect Reduction Expectancies Predict Smoking Behavior and Emotion

Regulation Skills

Despite the wealth of evidence demonstrating that smoking does not actually

reduce negative affect (with the exception of NA primarily due to nicotine withdrawal),

many smokers retain the belief that smoking will relieve negative affect. The current

analyses provide evidence that, among daily smokers, this belief is associated not only

with having stronger urges to smoke specifically in situations producing negative affect,

but also with stronger urges to smoke across all situations. As well, smokers who have

higher expectations that smoking will reduce negative affect overall smoke more

cigarettes and are more addicted to nicotine. These findings are consistent with new

findings reported by Carmody and colleagues (2012) showing that NA reduction

expectancies mediate the relation between PTSD symptoms and nicotine dependence.

Because people with deficits in emotion regulations skills can be expected to

attempt to reduce negative affect in other ways (including smoking), poorer emotion

regulation skills were expected to correlate with a tendency to expect smoking to reduce

negative affect. In this sample, deficits in ER skills and use of suppression as an ER strategy were both associated with expecting smoking to reduce NA affect. This is in line with other recent findings on the relation between difficulty with emotion regulation and expectancies for negative affect reduction (Johnson et al., 2008). However, there was no association between positive ER skills (i.e., reappraisal, mindfulness) and expectancies that smoking would reduce negative affect. Thus, expectancies that smoking will reduce NA seem to be most related to difficulty with effective use of emotion regulation skills, regardless of the level of more constructive emotion regulation skills. These results are consistent with the findings of a review by Nolen-Hoeksema and Aldao (2011), who found that depressive symptoms were associated with use of maladaptive, but not adaptive, emotion regulation strategies.

In sum, compared to nonsmokers, moderate daily smokers showed more stress and negative affect (e.g., more need for the regulation of negative emotion), as well as more deficits in emotion regulation and reliance on less effective emotion regulation skills such as suppression. These findings suggest one mechanism, health behaviors, by which deficits in emotion regulation could be associated with long-term health consequences. In addition, among smokers, expecting that smoking will reduce negative affect is associated with more deficits in skills to regulate negative emotion and more emotional suppression, and thus, perhaps unsurprisingly, also associated with smoking more cigarettes and being more addicted. In sum, these findings contribute to the literature on health behavior and emotion regulation by identifying deficits in emotion

regulation in a population with a significant health risk behavior, and suggesting an avenue for intervention.

Limitations

The current sample is relatively small and composed of a combination of students and members of the broader community who were on average light to moderate smokers, averaging a little less than half a pack per day, and were younger than some samples of smokers. However, the smoking pattern of these smokers is fairly similar to statewide data (Minnesota Department of Health, 2011), which show that the highest rates of smoking occur in younger adults (18-24) and that the majority of smokers across all age groups smoke less than 15 cigarettes per day (3/4 pack). To the extent that the smokers in this sample are not representative of the broader population of smokers, results of the current study may not generalize to a population of older or heavier smokers. As well, it is possible that the smoking and nonsmoking samples may differ on other variables not assessed in this study.

Additionally, the nonsmoking sample may not be entirely nonsmoking; the assumption was made based on smoking rate data from this specific population. Based on the population smoking rates, it is probable that there were 3 or 4 smokers whose responses were included among the 114 participants in the nonsmoking group. However, if the nonsmoking sample was contaminated with a few individuals who smoke, any group differences observed between the groups are that much more robust. Perhaps more concerning, these data rely on self-report. Although there is evidence to suggest that self-reported smoking history is comparably accurate with other methods (Soulavaka et al.,

2012), adding in-person objective measures of current smoking (e.g., carbon monoxide or cotinine) would add reliability to the data on current smoking behavior. Lastly, the data presented here are correlational and aggregate in nature, and (in contrast to the original planned analyses) lack the ability to identify causal relations between immediate use of a particular emotion regulation skill and subsequent emotional and behavioral outcomes.

Future Directions

The current study sets the stage for another step toward examining the role of emotion regulation in the maintenance and cessation of smoking. Two planned projects can build on this foundation. First, it would be beneficial to carry out the originally planned experimental study design within a context where there is a readily accessible population of regular smokers. Given the current results showing greater prevalence of trait suppression among smokers, it would be of particular interest to see whether the same brief emotion regulation manipulations are able to produce similar outcomes (as in Study 1 results), despite higher levels of trait suppression. Additionally, further study of the application of the emotion regulation strategies to more intense, sustained, or naturally occurring affect-inducing stressors could help clarify whether there can be benefit from use of reappraisal and mindfulness (rather than just harm from use of suppression). To apply emotion regulation skills interventions in a clinical pilot, it would be useful to have increased confidence that the instruction can produce beneficial results in smokers, as evidenced by some measurable differences in urges to smoke, latency to smoking, or a proxy measure such as the smoking Stroop.

The second stage of planned follow-up is the inclusion of an additional emotion regulation module within a structured behavioral health intervention. Specifically, the follow-up would add an emotion regulation component including cognitive reappraisal, mindfulness, or both, as an addition to an already well-established multidisciplinary hospital smoking cessation clinic. Taking advantage of the existing self-report and biological (e.g., carbon monoxide) monitoring would allow comparison of outcomes with and without the emotion regulation component.

Additionally, there is some evidence to suggest that negative affect may be a more significant barrier to cessation for women than for men (e.g., Perkins, Karelitz, Giedgowd, & Conklin, 2013). Application of the current findings to a mixed gender clinical intervention setting would allow for further exploration of potential gender differences in the importance of emotion regulation skills for smoking cessation.

In conclusion, there appear to be systematic deficits in emotion regulation skills in smokers compared to nonsmokers. Though the current study did not focus on smoking cessation, the majority of participants had made attempts to quit in the past year. If people who are trying to enact a healthy behavioral change have deficits in emotion regulation skills, or tend to rely on less beneficial emotion regulation skills, there is a clear avenue for intervention to facilitate the acquisition and effective application of emotion regulation skills in the service of improved health behaviors and health outcomes.

Table 1

Overview of Study 1 Design and Summary of Measures Used at Each Time Point

Time 1 Baseline Assessment	Time 2 Lab Session (Pre-Emotion Induction)	Time 2 Lab Session (Post-Emotion Induction)
Stress	Diary Card: Record of eating during the past 24 hours	*Presentation of video clip – emotion stimulus (same for all conditions)*
Depression	Description & time since last meal/snack	Distress SUDS
Anxiety	Hunger	Positive & Negative Affect
Mindfulness	Distress SUDS	Food preferences tasting task
Positive & Negative Affect	*Instruction for watching video clip (varies by condition)*	Manipulation check – emotion regulation strategy
Emotion Regulation		
Eating Behavior		
Eating Expectancies		
Demographics		

Table 2

Correlations Between Baseline Measures and Eating Outcomes

	Food A-Crackers	Food B – Chips	Food C – Chocolate	Distress	Negative Affect
Stress/Anxiety/Depression					
Perceived Stress	-.02	.13	.05	.43**	.36**
DASS-21	-.06	-.02	.19^	.46**	.24*
DASS-Stress	-.02	-.05	.14	.46**	.24^
DASS-Anxiety	-.04	-.00	.22^	.41**	.28*
DASS-Depression	-.12	.01	.17	.36**	.22^
Affect					
Positive Affect	-.01	-.10	-.08	-.14	-.03
Negative Affect	-.04	.10	.02	.37**	.31*
Eating Behavior					
Restricted	-.11	.02	.01	.27*	.16
Externalized	.04	.14	.07	.15	.17
Emotional Eating	.01	.01	.14	.36**	.17
Eating Expectancies					
Negative Affect	-.10	-.08	.13	.30*	.12
Rewarding	-.02	.09	.05	-.13	-.05
Out of Control	-.15	-.04	-.03	.39**	.27*
Enhance Cognition	.12	.06	.07	-.15	-.13
Boredom	-.08	.04	.10	.24^	.15

^ indicates correlation is significant at $p < .05$; *indicates $p < .01$; ** indicates $p < .001$.

For all correlations, $n = 114$, except correlations with distress for which $n = 112$.

Table 3

Correlations Between Baseline Measures of Emotion Regulation and Eating Outcomes

	n	Food A – Crackers	Food B – Chips	Food C – Chocolate	Distress	Negative Affect
ERQ						
ERQ-S	*114*	.02	.11	.02	-.05	.15
ERQ-CR	*114*	.07	-.08	-.01	-.24^	-.04
NMR	*114*	.10	-.06	-.06	-.35**	-.14
DERS	*114*	-.06	.06	.04	.37**	.27*
DERS-NA	*114*	-.04	-.09	-.06	.25*	.14
DERS-G	*114*	.03	.18	.03	.23^	.21^
DERS-I	*114*	-.05	.01	.16	31*	.25*
DERS-AW	*113*	-.14	.04	-.01	.04	.11
DERS-ST	*114*	-.03	.08	.05	.43**	.22^
DERS-CL	*114*	-.03	.04	.00	.27*	.21^
TEARS						
TEARS-A	*113*	.03	-.15	.05	-.08	-.05
TEARS-R	*113*	-.04	-.20^	.00	-.34**	-20^
Mindfulness						
MAAS	*114*	-.01	-.16	-.05	-.33**	-.22^

^ indicates correlation is significant at *p* < .05; * indicates *p* < .01; ** indicates *p* < .001.

Table 4

Means and SD of Affective and Emotion Regulation Variables Across Conditions

CONDITION		PSS	DASS	NA	PA	ERQ-S	ERQ-CR	DERS	NMR	MAAS
Control	*M*	1.82	1.44	1.79	3.47	3.07	5.19	2.20	3.80	3.82
	SD	.54	.52	.61	.71	1.25	.77	.62	.50	.81
	n	27	27	27	27	27	27	27	27	27
Suppression	*M*	1.94	1.55	1.90	3.02	3.54	4.79	2.40	3.42	3.61
	SD	.52	.48	.64	.71	1.23	1.33	.65	.64	1.03
	n	27	27	27	27	27	27	27	27	27
Mindfulness	*M*	1.81	1.45	1.83	3.27	3.43	5.30	2.18	3.77	3.75
	SD	.60	.57	.63	.80	1.50	1.01	.60	.57	.80
	n	29	29	29	29	29	29	29	29	28
Cognitive Reappraisal	*M*	1.82	1.29	1.92	3.49	3.20	5.01	2.15	3.75	3.67
	SD	.52	.36	.54	.65	1.14	.91	.58	.62	.76
	n	31	31	31	31	31	31	31	31	31
Total	*M*	1.84	1.43	1.86	3.32	3.31	5.07	2.23	3.69	3.71
	SD	.54	.49	.60	.73	1.28	1.03	.61	.60	.85
	n	114	114	114	114	114	114	114	114	113

Table 5

One-way ANOVA Planned Contrast Manipulation Check Results with Means and SD

from Pilot Study and Study 1

Manipulation Check ANOVA Contrasts			*F*	*t*	*df*	*p*
Pilot Study						
Check - S	*ANOVA*		10.97		1, 29	.002**
	Planned Contrast	S vs. M & CR		3.26	29	.003**
Check - M	*ANOVA*		4.21		1, 29	.03*
	Planned Contrast	M vs. S & CR		1.18	29	.25
Check - CR	*ANOVA*		4.70		1, 29	.01**
	Planned Contrast	CR vs. S & M		2.24	29	.05*
Study 1						
Check - S	*ANOVA*		15.37		1, 110	< .001***
	Planned Contrast	S vs. C, M, & CR		5.49	110	< .001***
Check - M	*ANOVA*		.16		1, 110	.65
	Planned Contrast	M vs. S, C, & CR		1.65	110	.10^
Check - CR	*ANOVA*		.43		1, 110	.53
	Planned Contrast	CR vs. S, C, & M		-.84	110	.40

			Manipulation Check Means Across Conditions		
	Condition	*n*	**Check-S**	**Check-M**	**Check-CR**
Pilot Study					
	Suppression	*11*	**4.64 (1.91)**	4.36 (1.12)	2.45 (1.21)
	Mindfulness	*11*	3.10 (1.45)	**5.60 (.84)**	2.60 (1.43)
	Cognitive Reappraisal	*10*	2.64 (.92)	5.36 (.81)	**4.00 (2.32)**
	Total	*32*	3.47 (1.69)	5.09 (1.06)	3.03 (1.82)
Study 1					
	Suppression	*27*	**4.93 (1.54)**	4.56 (1.55)	3.37 (2.04)
	Control	*27*	3.00 (1.69)	4.63 (1.42)	3.74 (1.79)
	Mindfulness	*29*	2.62 (1.54)	**5.07 (1.13)**	3.38 (1.88)
	Cognitive Reappraisal	*31*	3.19 (1.78)	4.58 (1.31)	**3.16 (1.85)**
	Total	*114*	3.41 (1.84)	4.71 (1.35)	3.40 (1.88)

Table 6

MANOVA and Planned Contrasts Results for Effects of Emotion Regulation Condition

on Distress and Negative Affect

		Wilk's Lambda	*F*	*df*	*p*	η_p^2
CONDITION	Multivariate	.928	1.33	6, 210	.25	.036
	Distress – SUDS		.88	3, 106	.35	.024
	PANAS – NA		2.55	3, 106	.06^	.067
S vs. M & CR	Multivariate	.971	1.57	2, 105	.21	.029
	Distress – SUDS		1.85	1, 106	.18	.017
	PANAS – NA		2.70	1, 106	.10^	.025
S & C vs. M & CR	Multivariate	.942	3.22	2, 105	.04*	.058
	Distress – SUDS		2.40	1, 106	.12	.022
	PANAS – NA		6.30	1, 106	.01*	.056
S vs. C	Multivariate	.993	.38	2,105	.68	.007
	Distress – SUDS		.03	1, 106	.87	.000
	PANAS – NA		.48	1, 106	.49	.004
M vs. CR	Multivariate	.990	.56	2, 105	.58	.010
	Distress – SUDS		.29	1, 106	.60	.003
	PANAS – NA		1.12	1, 106	.29	.010

* indicates p < .05; ^ indicates < .10

Table 7

Mean and SD of Distress and Negative Affect by Emotion Regulation Condition

	Distress – SUDS		Negative Affect	
	n	*M (SD)*	*n*	*M (SD)*
Suppression	*27*	42.47 (26.29)	*27*	1.76 (.51)
Control	*27*	41.56 (26.07)	*27*	1.86 (.61)
Mindfulness	*28*	34.79 (25.41)	*29*	1.52 (.37)
Cognitive Reappraisal	*30*	36.57 (21.95)	*31*	1.67 (.49)
Total	*112*	38.79 (25.56)	*114*	1.70 (.51)

Table 8

Planned Main Effect Contrast Weights Predicting Eating Outcomes by Condition

	Condition			
	Suppression	Control	Mindfulness	Cognitive Reappraisal
Contrast 1	-2	0	1	1
Contrast 2	-1	1	0	0
Contrast 3	0	0	-1	1

Table 9

Means and SD of Eating Outcomes by Emotion Regulation Condition

	n	Eating Outcomes		
		Bland Crackers	**Potato Chips**	**M&Ms**
	n	*M (SD)*	*M (SD)*	*M (SD)*
Suppression	*27*	12.75 (15.48)	11.76 (9.68)	34.62 (56.66)
Control	*27*	8.87 (8.83)	11.69 (8.70)	17.45 (14.44)
Mindfulness	*29*	7.43 (5.88)	11.45 (7.68)	15.01 (12.93)
Cognitive Reappraisal	*31*	7.26 (5.94)	8.80 (8.21)	17.93 (12.17)
Total	*114*	8.99 (9.79)	10.86 (8.55)	21.03 (30.44)

Table 10

ANOVA and Planned Contrast Results for the Effects of Emotion Regulation Condition

on Eating Outcomes

		F	df	p	η_p^2
Bland Crackers	Condition (main effect)	1.95	3, 110	.13	.050
	S vs. M & CR	5.82	1, 110	.02*	.050
	S vs. C	2.18	1, 110	.14	.019
	M vs. CR	.01	1, 110	.94	.000
Potato Chips	Condition (main effect)	.82	3, 110	.48	.022
	S vs. M & CR	.68	1, 110	.41	.006
	S vs. C	<.01	1, 110	.98	.000
	M vs. CR	1.43	1, 110	.24	.013
M&Ms	Condition (main effect)	2.50	3, 110	.06^	.064
	S vs. M & CR	6.88	1, 110	.01*	.059
	S vs. C	4.47	1, 110	.04*	.039
	M vs. CR	.14	1, 110	.71	.001

* indicates p < .05; ^ indicates p < .10

Table 11

Planned Interaction Effect Contrast Weights for Interactions* with Emotion Regulation

Condition on Eating Outcomes

	Low (ERQ-S, DERS, NMR)				High (ERQ-S, DERS, NMR)			
	Suppression	Control	Mindfulness	Cognitive Reappraisal	Suppression	Control	Mindfulness	Cognitive Reappraisal
Contrast 1	2	0	-1	-1	-2	0	1	1
Contrast 2	1	-1	0	0	-1	1	0	0
	Low (DEBQ-EE, EEI-NA)				High (DEBQ-EE, EEI-NA)			
	Suppression	Control	Mindfulness	Cognitive Reappraisal	Suppression	Control	Mindfulness	Cognitive Reappraisal
Contrast 1	2	0	-1	-1	-2	0	1	1
Contrast 2	1	-1	0	0	-1	1	0	0
	Low (Distress, NA)				High (Distress, NA)			
	Suppression	Control	Mindfulness	Cognitive Reappraisal	Suppression	Control	Mindfulness	Cognitive Reappraisal
Contrast 1	2	0	-1	-1	-2	0	1	1
Contrast 2	1	-1	0	0	-1	1	0	0

 *Planned contrasts for interactions between emotion regulation condition and the following: baseline emotion regulation style (ERQ-S, DERS), baseline emotional eating and expectancies (DEBQ-EE, EEI-NA), and post-emotion induction distress and negative affect.

Table 12

Two-way ANOVA and Planned Contrast Results for the Effect of Emotional Suppression

(ERQ-S) by Condition on Eating Outcomes

		F	df	p	η_p^2
Bland Crackers					
Main Effects	ERQ-S	.16	1, 106	.69	.002
	Condition	1.80	3, 106	.15	.048
Interaction	ERQ-S X Condition	.51	3, 106	.68	.014
Planned Contrasts	ERQ-S X S vs. M & CR	.40	1, 106	.53	.004
	ERQ-S X S vs. C	.35	1, 106	.56	.003
Potato Chips					
Main Effects	ERQ-S	.81	1, 106	.37	.008
	Condition	.75	3, 106	.52	.022
Interaction	ERQ-S X Condition	.05	3, 106	.99	.001
Planned Contrasts	ERQ-S X S vs. M & CR	.04	1, 106	.84	.001
	ERQ-S X S vs. C	.02	1, 106	.89	.000
M&Ms					
Main Effects	ERQ-S	.22	1, 106	.64	.002
	Condition	2.44	3, 106	.07^	.063
Interaction	ERQ-S X Condition	1.58	3, 106	.20	.042
Planned Contrasts	ERQ-S X S vs. M & CR	4.29	1, 106	.04*	.039
	ERQ-S X S vs. C	2.99	1, 106	.09^	.027

*indicates p < .05; ^ indicates p < .10

Table 13

Two-way ANOVA and Planned Contrast Results for the Effect of Difficulty with

Emotion Regulation (DERS) by Condition on Eating Outcomes

		F	df	p	η_p^2
Bland Crackers					
Main Effects	DERS	.54	1, 106	.46	.005
	Condition	1.52	3, 106	.22	.041
Interaction	DERS X Condition	1.84	3, 106	.14	.050
Planned Contrasts	DERS X S vs. M & CR	2.74	1, 106	.10^	.025
	DERS X S vs. C	4.38	1, 106	.04*	.040
Potato Chips					
Main Effects	DERS	.11	1, 106	.75	.001
	Condition	.75	3, 106	.53	.021
Interaction	DERS X Condition	.94	3, 106	.43	.025
Planned Contrasts	DERS X S vs. M & CR	1.39	1, 106	.24	.013
	DERS X S vs. C	1.79	1, 106	.18	.017
M&Ms					
Main Effects	DERS	.10	1, 106	.75	.001
	Condition	2.45	3, 106	.07^	.065
Interaction	DERS X Condition	.07	3, 106	.97	.002
Planned Contrasts	DERS X S vs. M & CR	.16	1, 106	.69	.002
	DERS X S vs. C	.02	1, 106	.89	.000

* indicates p < .05; ^ indicates p < .10

Table 14

Two-way ANOVA and Planned Contrast Results for the Effect of Emotional Eating

(DEBQ-EE) by Condition on Eating Outcomes

		F	*df*	*p*	η_p^2
Bland Crackers					
Main Effects	DEBQ-EE	.14	1, 106	.71	.001
	Condition	1.74	3, 106	.16	.047
Interaction	DEBQ-EE X Condition	.52	3, 106	.67	.015
Planned Contrasts	DEBQ-EE X S vs. M & CR	.65	1, 106	.42	.006
	DEBQ-EE X S vs. C	.05	1, 106	.83	.000
Potato Chips					
Main Effects	DEBQ-EE	.34	1, 106	.56	.003
	Condition	.78	3, 106	.51	.022
Interaction	DEBQ-EE X Condition	.07	3, 106	.98	.002
Planned Contrasts	DEBQ-EE X S vs. M & CR	.03	1, 106	.87	.000
	DEBQ-EE X S vs. C	.06	1, 106	.81	.001
M&Ms					
Main Effects	DEBQ-EE	2.73	1, 106	.10	.025
	Condition	1.71	3, 106	.17	.046
Interaction	DEBQ-EE X Condition	2.62	3, 106	.06^	.069
Planned Contrasts	DEBQ-EE X S vs. M & CR	7.19	1, 106	.009**	.063
	DEBQ-EE X S vs. C	4.95	1, 106	.03*	.045

** indicates *p* < .01; * indicates *p* < .05; ^ indicates *p* < .10

Table 15

Two-way ANOVA and Planned Contrast Results for the Effect of Negative Affect Eating

Expectancies (EEI-NA) by Condition on Eating Outcomes

		F	df	p	η_p^2
Bland Crackers					
Main Effects	EEI-NA	<.01	1, 106	.97	.000
	Condition	1.86	3, 106	.14	.050
Interaction	EEI-NA X Condition	.56	3, 106	.64	.016
Planned Contrasts	EEI-NA X S vs. M & CR	.16	1, 106	.69	.001
	EEI-NA X S vs. C	.52	1, 106	.47	.005
Potato Chips					
Main Effects	EEI-NA	.04	1, 106	.84	.000
	Condition	.99	3, 106	.40	.027
Interaction	EEI-NA X Condition	1.79	3, 106	.15	.048
Planned Contrasts	EEI-NA X S vs. M & CR	1.13	1, 106	.29	.011
	EEI-NA X S vs. C	5.11	1, 106	.03*	.046
M&Ms					
Main Effects	EEI-NA	1.71	1, 106	.19	.016
	Condition	2.07	3, 106	.11	.055
Interaction	EEI-NA X Condition	2.99	3, 106	.03*	.078
Planned Contrasts	EEI-NA X S vs. M & CR	8.21	1, 106	.005**	.072
	EEI-NA X S vs. C	5.69	1, 106	.02*	.051

** indicates $p < .01$; * indicates $p < .05$; ^ indicates $p < .10$

Table 16

Snacking Means and SD across Conditions for Emotion Regulation and Emotional Eating

Moderators*

	Low Emotional Suppression				High Emotional Suppression			
	S	**C**	**M**	**CR**	**S**	**C**	**M**	**CR**
M&Ms								
M	22.08	19.01	17.74	19.52	46.26	14.34	12.47	15.99
SD	27.61	14.83	12.79	13.82	73.58	13.91	12.98	9.96
N	*13*	*18*	*14*	*17*	*14*	*9*	*15*	*14*

	Low DERS				High DERS			
	S	**C**	**M**	**CR**	**S**	**C**	**M**	**CR**
Crackers								
M	9.47	11.71	9.54	7.23	14.68	5.81	4.84	7.28
SD	9.77	10.79	6.50	5.54	18.03	4.83	3.83	6.54
N	*10*	*14*	*16*	*16*	*17*	*13*	*13*	*15*

	Low Emotional Eating				High Emotional Eating			
	S	**C**	**M**	**CR**	**S**	**C**	**M**	**CR**
M&Ms								
M	13.11	17.24	14.52	18.62	49.41	17.75	15.47	17.19
SD	9.74	16.07	14.09	10.61	70.20	12.44	12.24	13.99
N	*11*	*16*	*14*	*16*	*16*	*11*	*15*	*15*

	Low Eating Expectancies – NA				High Eating Expectancies – NA			
	S	**C**	**M**	**CR**	**S**	**C**	**M**	**CR**
M&Ms								
M	14.59	18.29	16.88	18.89	50.64	16.24	13.27	17.13
SD	9.32	16.04	13.47	10.44	72.63	12.38	12.63	13.70
N	*12*	*16*	*14*	*14*	*15*	*11*	*15*	*17*

* Moderators include: Emotional Suppression (ERQ-S); Difficulty with Emotion Regulation (DERS); Emotional Eating (DEBQ-EE); and Expectancies that Eating will Reduce Negative Affect (EEI-NA).

Table 17

Snacking Means and SD across Conditions for Negative Affect and Distress Moderators

	Low Negative Affect				High Negative Affect			
	S	**C**	**M**	**CR**	**S**	**C**	**M**	**CR**
Crackers								
M	16.94	10.29	8.04	5.29	10.29	7.23	6.45	9.10
SD	21.61	10.96	6.64	3.92	10.45	6.87	4.49	6.98
N	*10*	*12*	*18*	*15*	*17*	*15*	*11*	*16*
Chips								
M	16.41	9.18	9.32	6.50	9.02	13.69	14.93	10.96
SD	12.51	8.48	6.77	5.64	6.53	8.62	8.11	9.73
N	*10*	*12*	*18*	*15*	*17*	*15*	*11*	*16*
	Low Distress – SUDS				High Distress – SUDS			
	S	**C**	**M**	**CR**	**S**	**C**	**M**	**CR**
M&Ms								
M	55.38	15.09	12.94	17.39	20.34	19.08	19.19	17.74
SD	81.42	12.50	12.27	12.41	24.73	15.82	13.77	12.41
N	*11*	*11*	*17*	*16*	*16*	*16*	*11*	*14*

Table 18

Two-way ANOVA and Planned Contrast Results for the Effect of Negative Affect by

Condition on Eating Outcomes

		F	*df*	p	η_p^2
Bland Crackers					
Main Effects	NA	.91	1, 106	.34	.008
	Condition	2.59	3, 106	.06^	.068
Interaction	NA X Condition	1.41	3, 106	.24	.038
Planned Contrasts	NA X S vs. M & CR	2.85	1, 106	.09^	.026
	NA X S vs. C	.58	1, 106	.45	.005
Potato Chips					
Main Effects	NA	1.30	1, 106	.26	.012
	Condition	1.33	3, 106	.27	.036
Interaction	NA X Condition	3.58	3, 106	.02*	.092
Planned Contrasts	NA X S vs. M & CR	9.94	1, 106	.002**	.086
	NA X S vs. C	6.73	1, 106	.01*	.060
M&Ms					
Main Effects	NA	.77	1, 106	.38	.007
	Condition	1.82	3, 106	.15	.049
Interaction	NA X Condition	.38	3, 106	.77	.011
Planned Contrasts	NA X S vs. M & CR	1.08	1, 106	.30	.010
	NA X S vs. C	.39	1, 106	.53	.004

** indicates p < .01; * indicates p < .05; ^ indicates p < .10

Table 19

Two-way ANOVA and Planned Contrast Results for the Effect of Distress by Condition

on Eating Outcomes

		F	*df*	p	η_p^2
Bland Crackers					
Main Effects	Distress	6.82	1, 104	.01*	.062
	Condition	2.79	3, 104	.04*	.074
Interaction	Distress X Condition	.85	3, 104	.47	.024
Planned Contrasts	Distress X S vs. M & CR	2.47	1, 104	.12	.023
	Distress X S vs. C	1.22	1, 104	.27	.012
Potato Chips					
Main Effects	Distress	.04	1, 104	.84	.000
	Condition	.83	3, 104	.48	.023
Interaction	Distress X Condition	1.17	3, 104	.33	.033
Planned Contrasts	Distress X S vs. M & CR	1.95	1, 104	.17	.018
	Distress X S vs. C	3.30	1, 104	.07^	.031
M&Ms					
Main Effects	Distress	1.18	1, 104	.28	.011
	Condition	3.38	3, 104	.02*	.089
Interaction	Distress X Condition	2.89	3, 104	.04*	.077
Planned Contrasts	Distress X S vs. M & CR	7.62	1, 104	.007**	.068
	Distress X S vs. C	5.77	1, 104	.02*	.053

** indicates p < .01; * indicates p < .05; ^ indicates p < .10

Table 20

Demographics of Smokers and Nonsmokers

	Nonsmokers *(n = 114)*	Smokers *(n = 99)*
Gender		
Male	34.4%	38.4%
Female	63.8%	47.5%
Did not report	1.8%	14.1%
Age		
18-21	77.9%	32.3%
22-25	17.7%	18.2%
26-29	2.7%	13.1%
30-33	--	9.0%
34-45	1.8%	6.0%
45+	--	7.1%
Did not report	--	14.1%
Race/Ethnicity		
African/African American/Black	9.7%	7.1%
Arabic/Middle Eastern	.9%	2.0%
Asian/Asian American	24.8%	14.1%
Hispanic/Latino(a)/Mexican American	1.8%	1.0%
Native American	.9%	4.0%
White/European American	59.3%	55.6%
Bi/Multiracial	2.7%	3.0%
Did not report	--	13.1%
Recruitment Source		
Psychology Courses	100.0%	22.2%
Other University Students	--	23.2%
Community	--	54.6%

Table 21

Means and SD of Affective and Emotion Regulation Variables for Smokers and

Nonsmokers.

	Affect				Emotion Regulation				
	PSS	**DASS**	**PA**	**NA**	**ERQ-S**	**ERQ-CR**	**DERS**	**NMR**	**MAAS**
Nonsmokers									
M	1.84	1.43	3.32	1.86	3.31	5.07	2.23	3.69	3.71
SD	.54	.49	.73	.60	1.28	1.03	.61	.60	.85
N	*114*	*114*	*114*	*114*	*114*	*114*	*114*	*114*	*113*
Smokers									
M	2.10	1.73	3.29	2.22	3.82	4.59	2.50	3.43	3.43
SD	.47	.53	.60	.74	1.45	1.23	.64	.62	.99
N	*95*	*98*	*99*	*99*	*96*	*96*	*95*	*91*	*87*

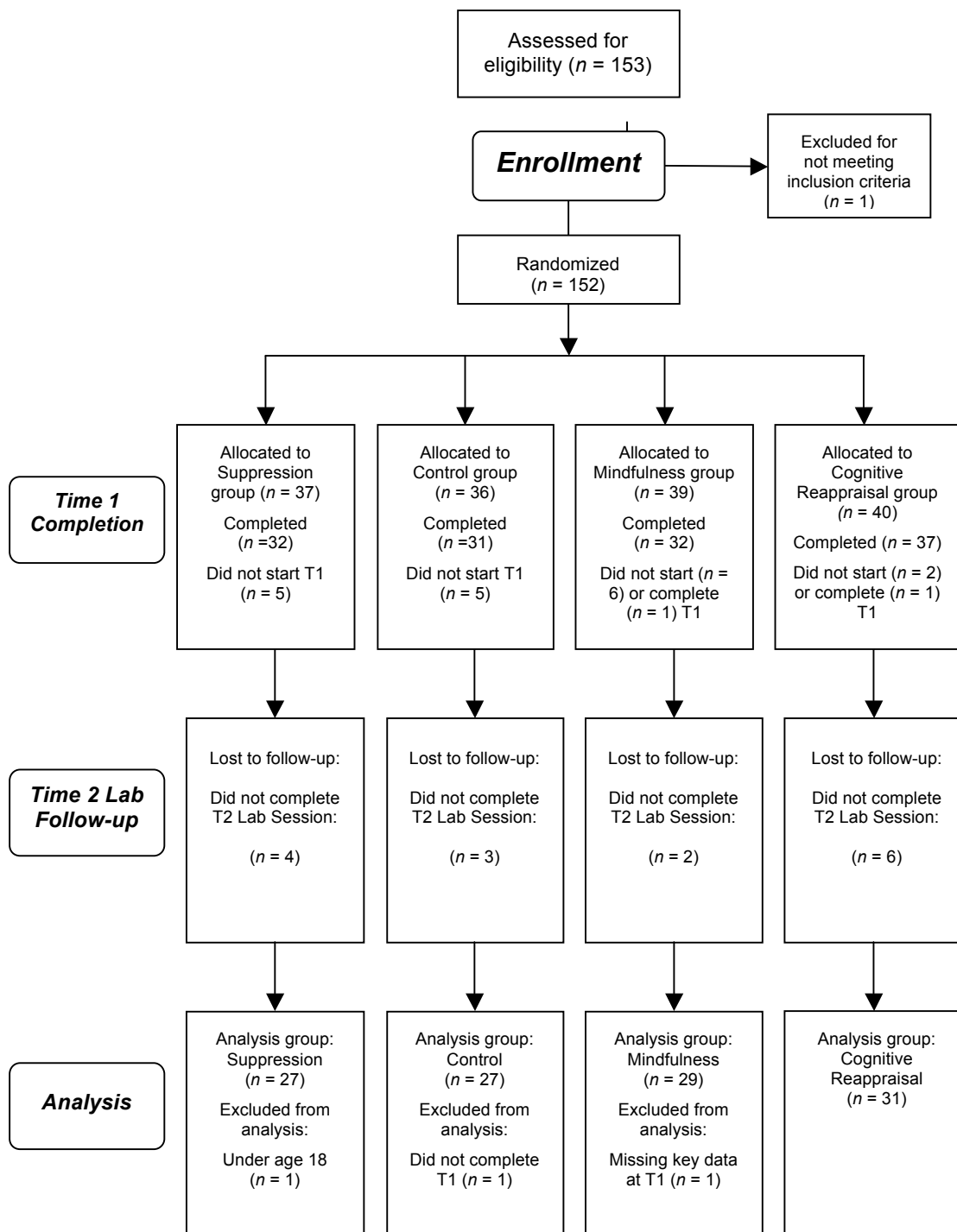Figure 1. Sampling and Flow of Participants in Study 1

Figure 2. Snacking as an Interaction between Trait Suppression and Emotion
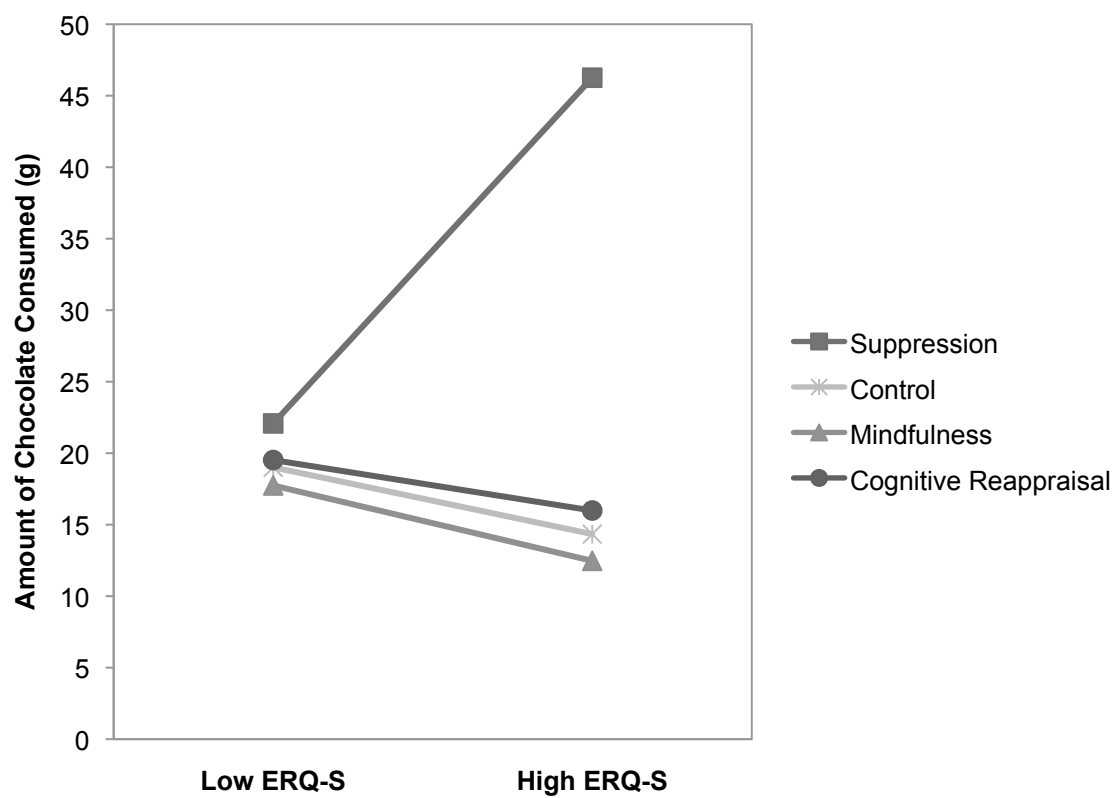
Regulation Condition (Chocolate)

Figure 3. Snacking as an Interaction between Emotion Regulation Difficulties and
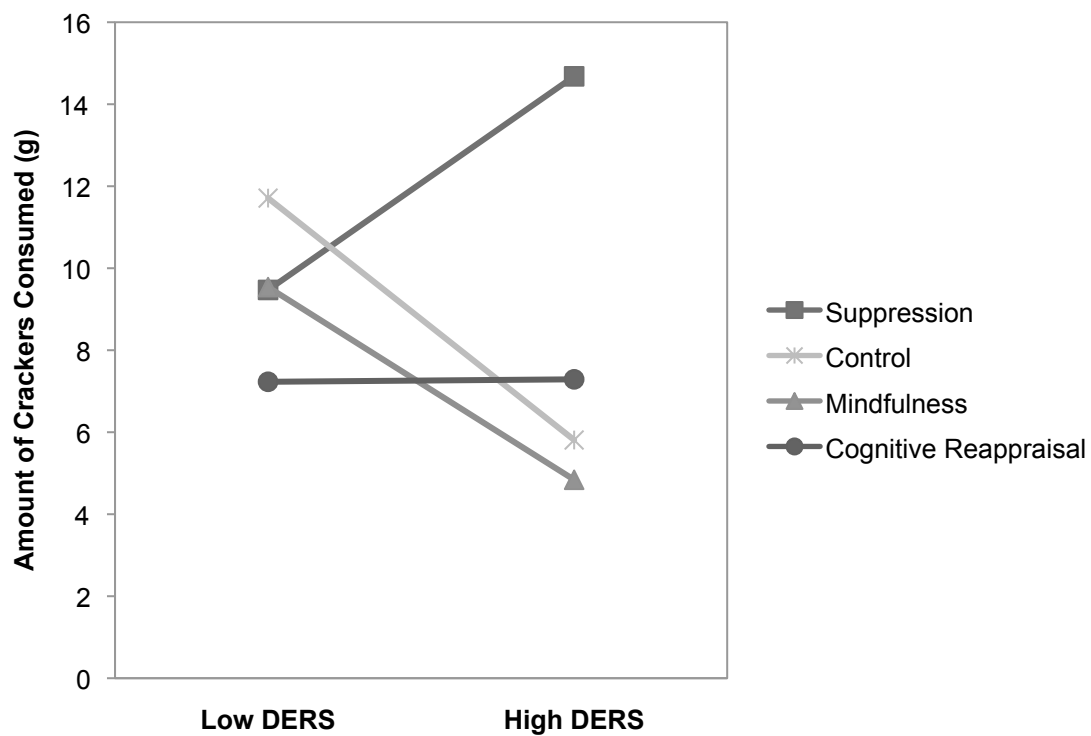Emotion Regulation Condition (Crackers)

Figure 4. Snacking as an Interaction between Emotional Eating and Emotion

Regulation Condition (Chocolate)

Figure 5. Snacking as an Interaction between Expectancies for Negative Affect

Reduction and Emotion Regulation Condition (Chocolate)
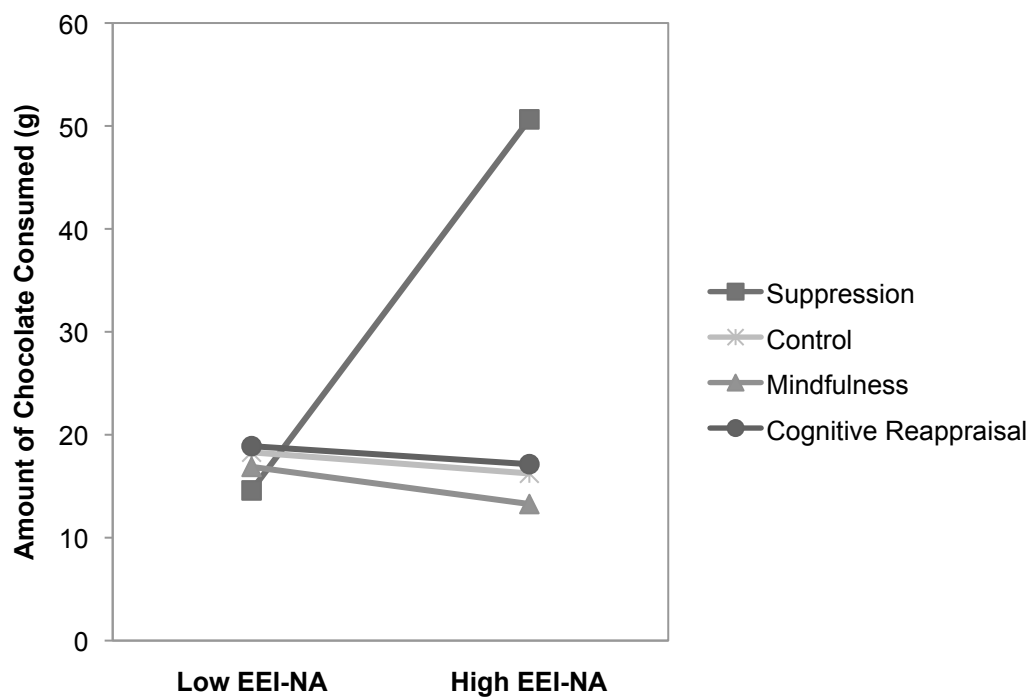
Figure 6. Snacking as an Interaction between Negative Affect and Emotion

Regulation Condition (Crackers)
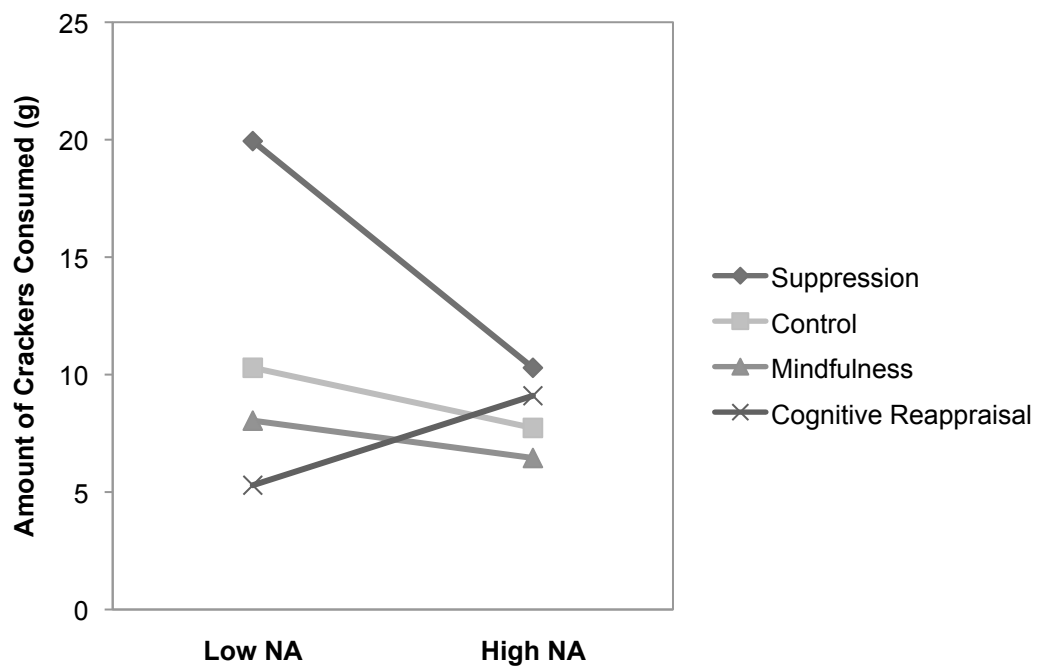
Figure 7. Snacking as an Interaction between Negative Affect and Emotion Regulation Condition (Chips)
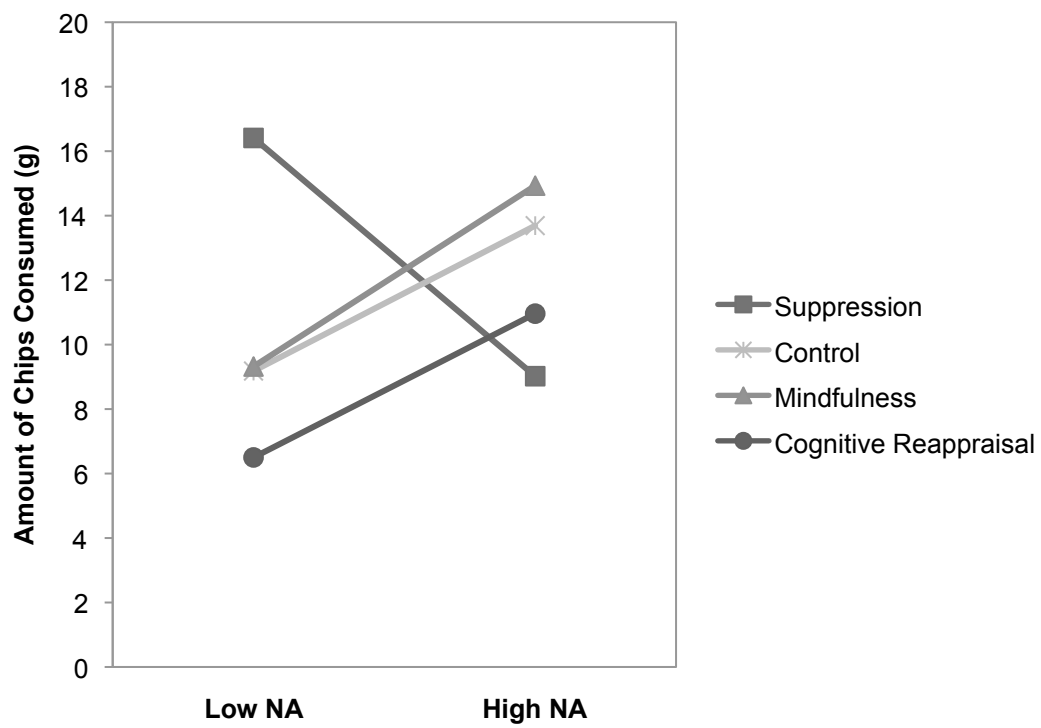
Figure 8. Snacking as an Interaction between Distress and Emotion Regulation
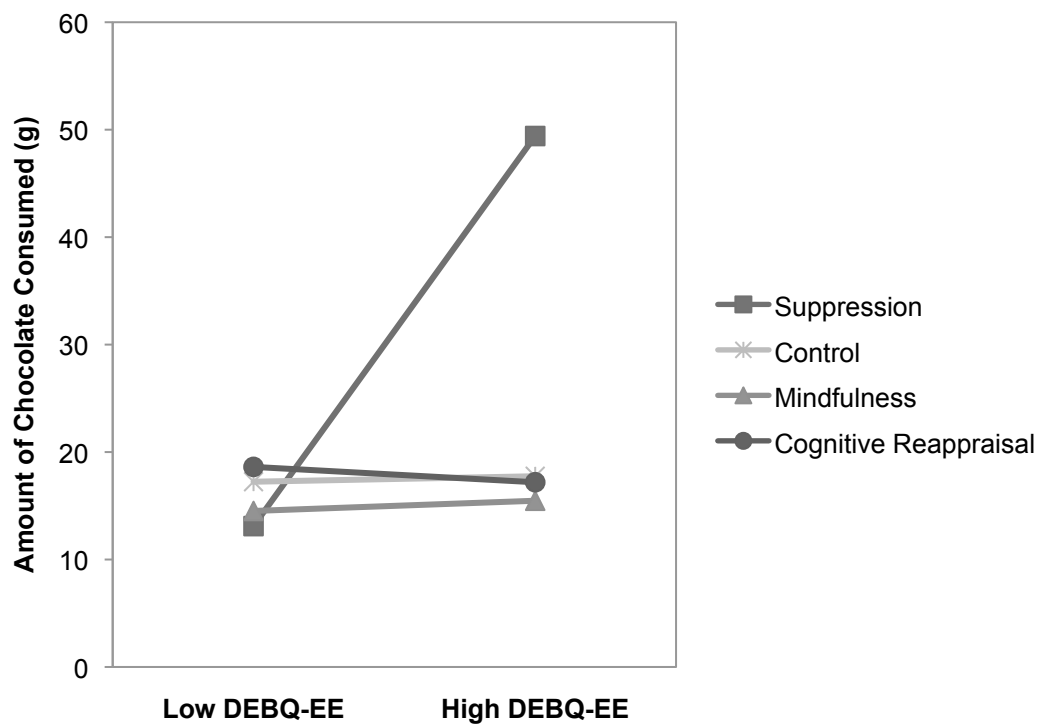
Condition (Chocolate)
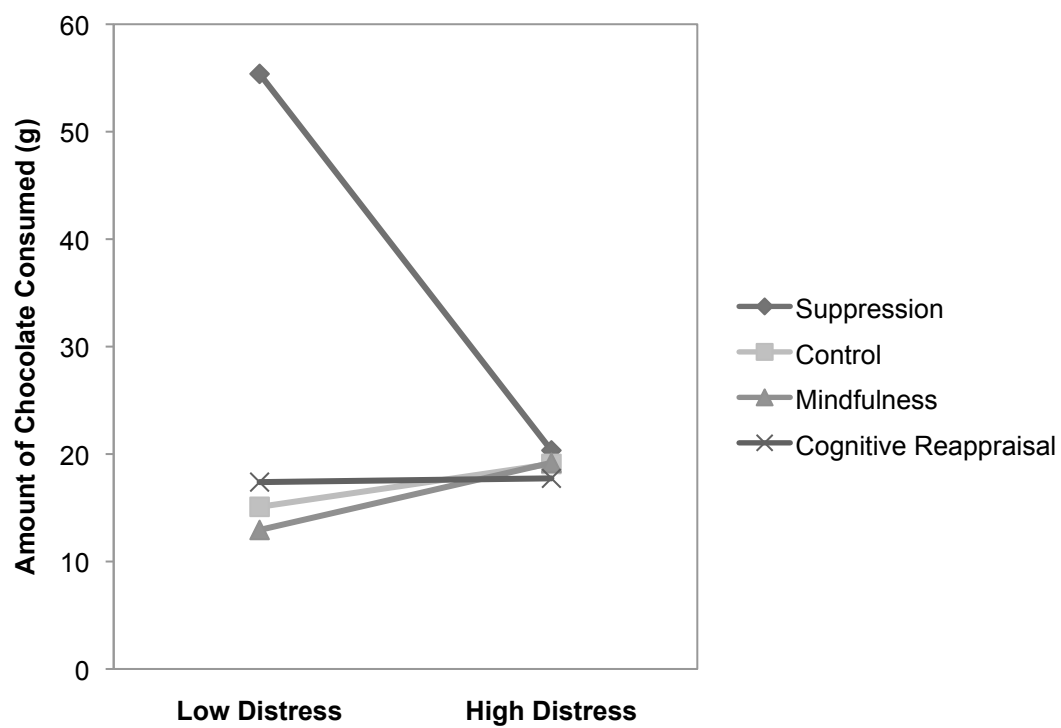
Figure 9. Sampling and Flow of Participants in Study 2 – Smoking
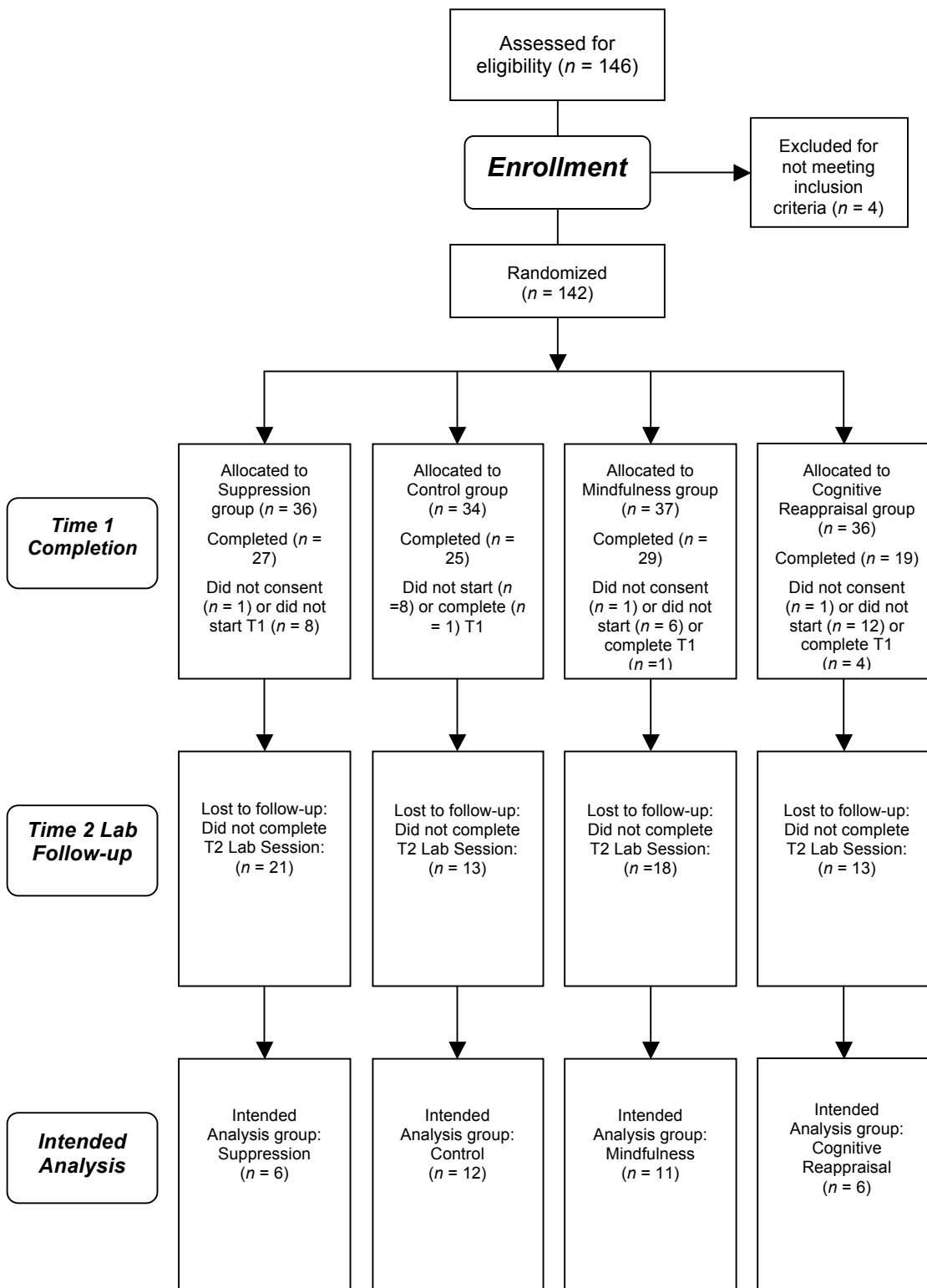
Figure 10. Mean Levels of Perceived Stress and Depression/Anxiety/Stress

for Nonsmokers and Smokers
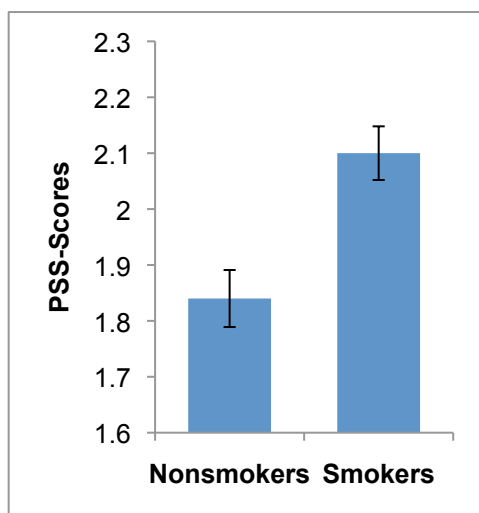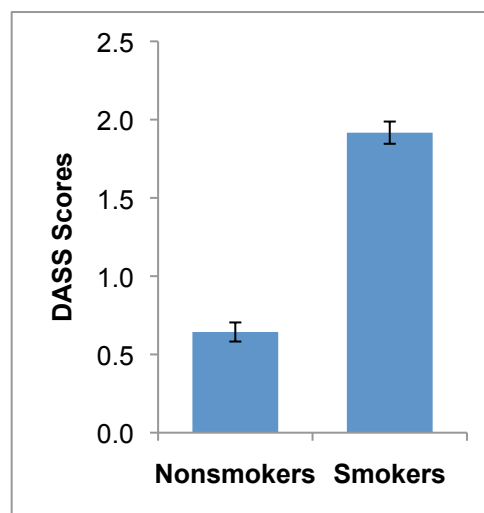
Perceived Stress   Depression/Anxiety/Stress

Figure 11. Mean Levels of Positive and Negative Affect For Nonsmokers and
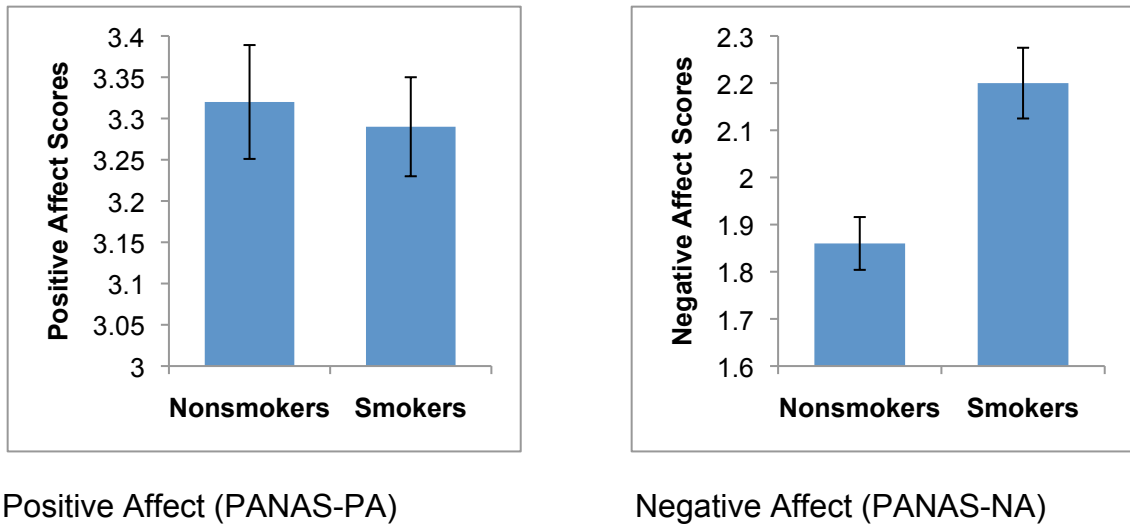
Smokers

Positive Affect (PANAS-PA)   Negative Affect (PANAS-NA)

Figure 12. Mean Levels of Negative Mood Regulation Skills and Cognitive

Reappraisal for Nonsmokers and Smokers
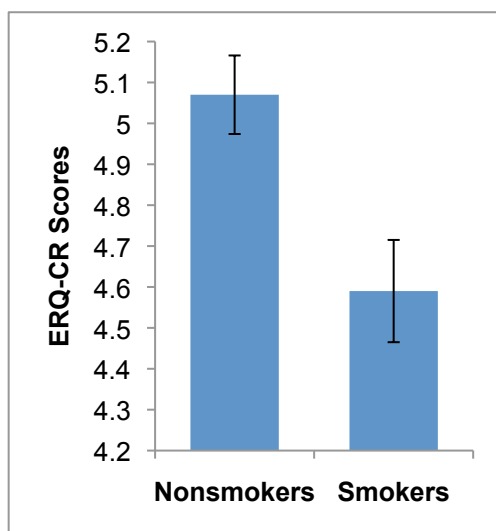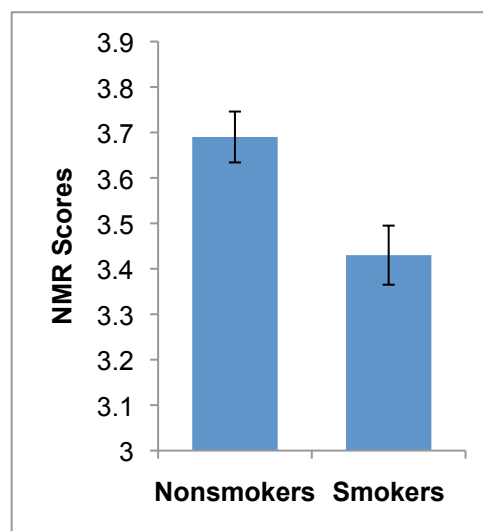
Cognitive Reappraisal (ERQ-CR)　　　　Negative Mood Regulation (NMR)

Figure 13. Mean Levels of Mindfulness (MAAS) for Nonsmokers and
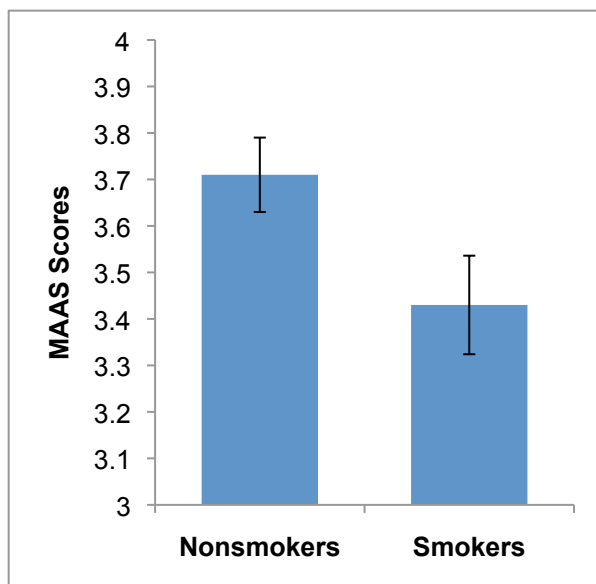
Smokers

Mindfulness (MAAS)

Figure 14. Mean Levels of Emotional Suppression and Difficulty with Emotion

Regulation for Nonsmokers and Smokers.
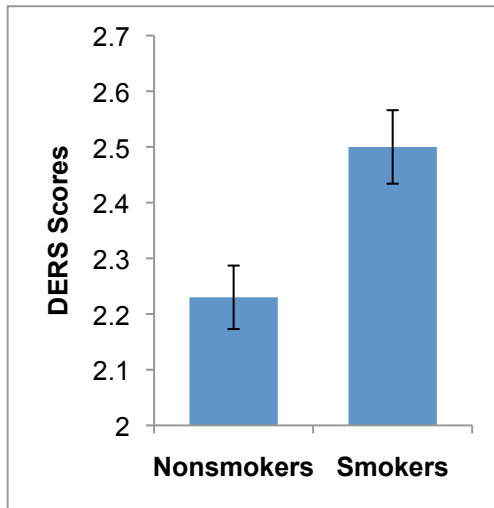
Difficulty with Emotion Regulation
(DERS)
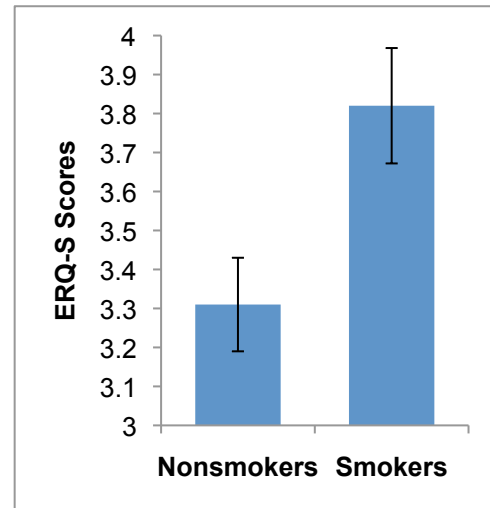
Emotional Suppression (ERQ-S)

References

Abelson, R. P., & Prentice, D. A. (1997). Contrast tests of interaction hypotheses. *Psychological Methods, 2,* 315–328.

Abrams, D. B., Monti, P. M., Pinto, R. P., Elder, J. P., Brown, R. A., & Jacobus, S. I. (1987). Psychosocial stress and coping in smokers who relapse or quit. *Health Psychology, 6,* 289-303.

Abrams, D. B., Monti, P. M., Carey, K. B., Pinto, R. P, & Jacobus, S. I. (1988). Reactivity to smoking cues and relapse: Two studies of discriminant validity. B*ehaviour Research & Therapy, 26*, 225-233.

Adler, N. E., Boyce, T., Chesney, M. A., Cohen, S., Folkman, S., Kahn, R. L., & Syme, S. L. (1994). Socioeconomic status and health: The challenge of the gradient. *American Psychologist, 49*, 15-24.

Achtzinger,A., Gollwitzer, P. M., & Sheeran, P. (2008). Implementation intentions and shielding goals from unwanted thoughts and feelings. *Personality & Social Psychology Bulletin, 34*, 381-393. doi: 10.1177/0146167207311201

Adam, T. C., & Epel, E. S. (2007). Stress, eating and the reward system. *Physiology & Behavior*, *91*, 449–458. doi:10.1016/j.physbeh.2007.04.01

Adriaanse, M. a, De Ridder, D. T. D., & Evers, C. (2011). Emotional eating: Eating when emotional or emotional about eating? *Psychology & Health, 26*, 23–39. doi:10.1080/08870440903207627

Adriaanse, M. A., Gollwitzer, P. M., de Ridder, D. T. D., de Wit, J. B. F., & Kroese, F. M. (2011). Breaking habits with implementation intentions: A test of underlying processes. *Personality & Social Psychology Bulletin, 37*, 502-513. doi: 10.1177/0146167211399102

Adriaanse, M. A., van Oosten, J. M., F., de Ridder, D. T. D., de Wit, J. B. F., & Evers, C. (2011). Planning what not to eat: Ironic effects of implementation intentions negating unhealthy habits. *Personality & Social Psychology Bulletin, 37*, 69-81. doi: 10.1177/0146167210390523

al'Absi, M. (2006). Altered psychoendocrine responses to psychological stress and smoking relapse. *International Journal of Psychophysiology, 59*, 218-227.

Aldao, A., & Nolen-Hoeksema, S. (2012). The influence of context on the implementation of adaptive emotion regulation strategies. *Behaviour Research & Therapy*, *50*, 493–501. doi:10.1016/j.brat.2012.04.004

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*, 217-237. doi:10.1016/j.cpr.2009.11.004

Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science & Practice, 10*, 125-143. doi:10.1093/clipsy/bpg015

Baer, R. A., Fischer, S., & Huss, D. B. (2006). Mindfulness and acceptance in the treatment of disordered eating. *Journal of Rational-Emotive & Cognitive-Behavior Therapy, 23*, 281–300. doi:10.1007/s10942-005-0015-9

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

Baladi, M. G., Daws, L. C., & France, C. P. (2012). Neuropharmacology You are what you eat: Influence of type and amount of food consumed on central dopamine systems and the behavioral effects of direct- and indirect-acting dopamine receptor agonists. *Neuropharmacology*, *63*, 76–86. doi:10.1016/j.neuropharm.2012.02.005

Baldwin, A.S., Rothman, A.J., Hertel, A.W., Linde, J.A., Jeffery, R.W., … Lando, H. (2006). Specifying the determinants of the initiation and maintenance of behavior change: An examination of self-efficacy, satisfaction, and smoking cessation. *Health Psychology, 25*, 626-634. doi: 10.1037/0278-6133.25.5.626

Barlow, D. H. (1993). *Clinical handbook of psychological disorders* (2nd ed). New York: Guilford Press.

Barnes, R. D., & Tantleff-Dunn, S. (2010). Food for thought: Examining the relationship between food thought suppression and weight-related outcomes. *Eating Behaviors*, *11*, 175–179. http://dx.doi.org/10.1016/j.eatbeh.2010.03.001

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality & Social Psychology*, *74*, 1252–1265. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9599441

Baumeister, R. F., Faber, J. E., & Wallace, H. M. (1999). Coping and ego depletion: Recovery after the coping process. In C. R. Snyder (Ed.), *Coping: The psychology of what works* (pp. 50-69). New York: Oxford University Press.

Bebko, G. M., Franconeri, S. L., Ochsner, K. N., & Chiao, J. Y. (2011). Look before you regulate: Differential perceptual strategies underlying expressive suppression and cognitive reappraisal. *Emotion*, *11*, 732–42. doi:10.1037/a0024009

Beck, A. T. (1976). *Cognitive therapy and the emotional disorders*. Madison, CT: International Universities Press.

Bilkei-Gorzo, A., Racz, I., Michel, K., Darvas, M., Maldonado, R., & Zimmer, A. (2007). A common genetic predisposition to stress sensitivity and stress-induced nicotine craving. *Biological Psychiatry, 63,* 164-171.

Billings, A. G., & Moos, R. H. (1983). Social-environmental factors among light and heavy cigarette smokers: A controlled comparison with nonsmokers. *Addictive Behaviors, 8*, 381–391. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/6677079

Björntorp, P. (2001). Do stress reactions cause abdominal obesity and comorbidities? *Obesity Reviews*, *2*, 73–86. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12119665

Boon, B., Stroebe, W., Schut, H., & Ijntema, R. (2002). Ironic processes in the eating behaviour of restrained eaters. *British Journal of Health Psychology*, *7*, 1–10. doi:10.1348/135910702169303

Brandon, T. H., & Baker, T. B. (1991). The Smoking Consequences Questionnaire: The subjective expected utility of smoking in college students. *Psychological Assessment, 3,* 484-491.

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.

Brown, K. & Ryan, R. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. (2003). *Journal of Personality & Social Psychology*, *84*, 822-48.

Brown, R. A., Lejuez, C. W., Kahler, C. W., & Strong, D. R. (2002). Distress tolerance and duration of past smoking cessation attempts. *Journal of Abnormal Psychology, 111,* 180-185. doi: 10.1037/0021-843X.111.1.180

Bruce, B., & Wilfley, D. (1996). Binge eating among the overweight population: A serious and prevalent problem. *Journal of the American Dietetic Association*, *96*, 58–61.

Burns J. W., Quartana, P., Gilliam, W., Gray, E., Matsuura, J., Nappi, C., … Lofland, K. (2008). Effects of anger suppression on pain severity and pain behaviors among chronic pain patients: Evaluation of an ironic process model. *Health Psychology, 27*, 645-652. doi: 10.1037/a0013044

Calhoun, P. S., Dennis, M. F., & Beckham, J. C. (2007). Emotional reactivity to trauma stimuli and duration of past smoking cessation attempts in smokers with posttraumatic stress disorder. *Experimental & Clinical Psychopharmacology, 15*, 256-263. doi: 10.1037/1064-1297.15.3.256

Campbell-Sills, L., Barlow, D. H., Brown, T. A, & Hofmann, S. G. (2006). Acceptability and suppression of negative emotion in anxiety and mood disorders. *Emotion*, *6*, 587–95. doi:10.1037/1528-3542.6.4.587

Carmody, T. P. (1989). Affect regulation, nicotine addiction, and smoking cessation. *Journal of Psychoactive Drugs, 21*, 331-341.

Carmody, T. P., McFall, M., Saxon, A. J., Malte, C. A, Chow, B., Joseph, A. M., … & Cook, J. W. (2012). Smoking outcome expectancies in military veteran smokers with posttraumatic stress disorder. *Nicotine & Tobacco Research, 14*, 919–926. doi:10.1093/ntr/ntr304

Carmody, T. P., Vieten, C., & Astin, J. A. (2007). Negative affect, emotional acceptance, and smoking cessation. *Journal of Psychoactive Drugs, 39*, 499-508.

Carver, C. S., & Scheier, M. F. (1998). *On the self-regulation of behavior.* New York: Cambridge University Press.

Catanzaro, S. J., & Mearns, J. (1990). Measuring generalized expectancies for negative mood regulation: Initial scale development and implications. *Journal of Personality Assessment, 54*, 546-563.

Catanzaro, S. J., & Mearns, J. (1999). Mood-related expectancy, emotional experience, and coping behavior. In I. Kirsch (Ed.), *Expectancy, experience and behavior* (pp. 67 - 91). Washington, DC: American Psychological Association.

Center for Disease Control (CDC). (2001). Cigarette smoking among adults – United States, 1999. *Morbidity and Mortality Weekly Report, 50,* 869-873.

Center for Disease Control (CDC). (2002). Annual smoking-attributable mortality, years of potential life lost, and economic costs --- United States, 1995--1999. *Morbidity and Mortality Weekly Report, 51,* 300-303.

Chambless, D. L., & Ollendick, T. H. (2001). Empirically supported psychological interventions: Controversies and evidence. *Annual Review of Psychology, 52*, 685-716. Doi: 10.1146/annurev.psych.52.1.685

Cinciripini, P. M., Cinciripini, L. G., Wallfisch, A., Haque, W., Van Vunakis, H. (1996). Behavior therapy and the transdermal nicotine patch: Effects on cessation outcome, affect, and coping. *Journal of Consulting & Clinical Psychology, 64*, 314-325.

Clyne, C., & Blampied, N. M. (2004). Training in emotion regulation as a treatment for binge eating: A preliminary study. *Behaviour Change*, *21*, 269–281. Retrieved from http://www.atypon-link.com/AAP/doi/abs/10.1375/bech.21.4.269.66105

Clyne, C., Latner, J. D., Gleaves, D. H., & Blampied, N. M. (2010). Treatment of emotional dysregulation in full syndrome and subthreshold binge eating disorder. *Eating Disorders*, *18*, 408–24. doi:10.1080/10640266.2010.511930

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health & Social Behavior, 24*, 385-396.

Cohen, S., & Lichtenstein, E. (1990). Partner behaviors that support quitting smoking. *Journal of Consulting & Clinical Psychology, 58*, 304-309.

Colleti, G., Supnick, J. A., & Payne, T. J. (1985). The Smoking Self-Efficacy Questionnaire (SSEQ): Preliminary scale development and validation. *Behavioral Assessment, 7*, 249-260.

Collins, R. L., & Ricciardelli, L. A. (2005). Assessment of eating disorders. In D. M. Donovan & G. A. Marlatt (Eds.), *Assessment of addictive behaviors* (2nd ed., pp. 305-333). New York: Guilford Press.

Conner, M., Fitter, M., & Fletcher, W. (1999). Stress and snacking: A diary study of daily hassles and between-meal snacking. *Psychology & Health*, *14*, 51–63.

Condiotte, M. M., & Lichtenstein, E. (1981). Self-efficacy and relapse in smoking cessation programs. *Journal of Consulting & Clinical Psychology, 49*, 648-658.

Cook, J., Spring, B., McChargue, D., & Doran, N. (2010). Effects of anhedonia on days to relapse among smokers with a history of depression: A brief report. *Nicotine & Tobacco Research, 12*, 978-982. doi: 10.1093/ntr/ntq118

Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality & Social Psychology, 69*, 990-1005.

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.

Crawford, J. R., & Henry, J. D. (2003). The Depression Anxiety Stress Scales (DASS): Normative data and latent structure in a large non-clinical sample. *British Journal of Clinical Psychology, 42*, 111–131. doi:10.1348/014466505X29657

Crowther, J. H., Sanftner, J., Bonifazi, D. Z., & Shepherd, K. L. (2001). The role of daily hassles in binge eating. *International Journal of Eating Disorders*, *29*, 449–454. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11285582

Currie, S. R., Hodgins, D. C., el-Guebaly, N., & Campbell, W. (2001). Influence of depression and gender on smoking expectancies and temptations in alcoholics in early recovery. *Journal of Substance Abuse, 13*, 443–458.

Curry, S., Marlatt, G.A., & Gordon, J.R. (1987). Abstinence Violation Effect: Validation of an attributional construct with smoking cessation. *Journal of Consulting and Clinical Psychology, 55*, 145-149.

D'Angelo, M. E. S., Reid, R. D., Hotz, S., Irvine, J., Segal, R. J., Blanchard, C. M., & Pipe A. (2005). Is stress management training a useful addition to physician advice and nicotine replacement therapy during smoking cessation in women? Results of a randomized trial. *American Journal of Health Promotion, 20*, 127-134.

Dagher, A., Tannenbaum, B., Hayashi, T., Pruessner, J. C., & McBride, D. (2009). An acute psychosocial stress enhances the neural response to smoking cues. *Brain Research, 1293*, 40-48.

Dar, R., Stronguin, F., Marouani, R., Krupsky, M., & Frenk, H. (2005). Craving to smoke in orthodox Jewish smokers who abstain on the Sabbath: A comparison to a baseline and a forced abstinence workday. *Psychopharmacology, 183*, 294-299.

Davis, C., Levitan, R. D., Yilmaz, Z., Kaplan, A. S., Carter, J. C., & Kennedy, J. L. (2012). Binge eating disorder and the dopamine D2 receptor: Genotypes and sub-phenotypes. *Progress in Neuropsychopharmacology & Biological Psychiatry*, *38*, 328–335. doi:10.1016/j.pnpbp.2012.05.002

Denollet, J., Martens, E. J., Nyklícek, I., Conraads, V. M., & de Gelder, B. (2008). Clinical events in coronary patients who report low distress: Adverse effect of repressive coping. *Health Psychology, 27*, 302-308.

Dingemans, A. E., Martijn, C., Jansen, A. T. M., & Furth, E. F. V. (2009). The effect of suppressing negative emotions on eating behavior in binge eating disorder. *Eating Disorders*, *52*, 51–57. doi:10.1016/j.appet.2008.08.004

Ditre, J. W. & Brandon, T. H. (2008). Pain as a motivator of smoking: Effects of pain induction on smoking urge and behavior. *Journal of Abnormal Psychology, 117*, 467-472. doi: 10.1037/0021-843X.117.2.467

Doran, N., Cook, J., McChargue, D., Myers, M., & Spring, B. (2008). Cue-elicited negative affect in impulsive smokers. *Psychology of Addictive Behaviors, 22*, 249–256. doi:10.1037/0893-164X.22.2.249

Dubé, L., LeBel, J. L., & Lu, J. (2005). Affect asymmetry and comfort food consumption. *Physiology & Behavior*, *86*, 559–67. doi:10.1016/j.physbeh.2005.08.023

Dunn, B. D., Billotti, D., Murphy, V., & Dalgleish, T. (2009). The consequences of effortful emotion regulation when processing distressing material: A comparison of suppression and acceptance. *Behaviour Research & Therapy*, *47*, 761–773. doi:10.1016/j.brat.2009.05.007

Emmons, K. M., Weidner, G., & Collins, R. L. (1989). Smoking cessation and cardiovascular reactivity to stress. *Journal of Behavioral Medicine, 12*, 587-598.

Erber, R., & Erber, M. W. (2000). The self-regulation of moods: Second thoughts on the importance of happiness in everyday life. *Psychological Inquiry, 11*, 142-148.

Etter, J. F., Bergman, M. M., Humair, J. P., & Perneger, T. V. (2000). Development and validation of a scale measuring self-efficacy of current and former smokers. *Addiction, 95*, 901–913. Retrieved from http://onlinelibrary.wiley.com/doi/10.1046/j.1360-0443.2000.9569017.x/abstract

Evers, C., Stok, M. F., & de Ridder, D. T. D. (2010). Feeding your feelings: emotion regulation strategies and emotional eating. *Personality & Social Psychology Bulletin*, *36*, 792–804. doi:10.1177/0146167210371383

Fagerström, K. O. (1978). Measuring degree of physical dependence to tobacco smoking with reference to individualization of treatment. *Addictive Behaviors, 3*, 235–241.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149-1160.

Fernander, A., & Schumacher, M. (2008). An examination of socio-culturally specific stress and coping factors on smoking status among African American women. *Stress and Health, 24*, 365–374. doi: 10.1002/smi.1214

Finkelstein, E. A., Ruhm, C. J., & Kosa, K. M. (2005). Economic causes and consequences of obesity. *Annual Review of Public Health, 26*, 239-257.

Fiore, M. C., Bailey, W. C., Cohen, S. J., Dorfman, S. F., Fox, B. J., Goldstein, M. J., …Baker, T. B. (2000). A clinical practice guideline for treating tobacco use and dependence. *Journal of the American Medical Association, 283,* 3244-3254.

Fiore, M. C., Jaén, C. R., Baker, T. B., Bailey, W. C., Benowitz, N., Curry, S. J., et al. (2008). *Treating tobacco use and dependence: 2008 Update, Clinical Practice Guideline.* Rockville, MD: U.S. Department of Health and Human Services, Public Health Service.

Fiore, M.C., Hatsukami, D.K., & Baker, T.B. (2002). Effective tobacco dependence treatment. *Journal of the American Medical Association, 288,* 1768-1771.

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: Exposure to corrective information. *Psychological Bulletin, 99*, 20-35.

Foss, B., & Dyrstad, S. M. (2011). Stress in obesity: Cause or consequence? *Medical Hypotheses*, *77*, 7–10. doi:10.1016/j.mehy.2011.03.011

Frazier, P., Anders, S., Perera, S., Tomich, P., Tennen, H., Park, C., & Tashiro, T. (2009). Traumatic events among undergraduate students: Prevalence and associated symptoms. *Journal of Counseling Psychology, 56*, 450-460. doi:10.1037/a0016412

Froelicher, E. S., Li, W.-W., Mahrer-Imhof, R., Christopherson, D., & Stewart, A. L. (2004). Women's Initiative for Non-Smoking (WINS) VI: Reliability and validity of health and psychosocial measures in women smokers with cardiovascular disease. *Heart & Lung, 33*, 162-175. doi:10.1016/j.hrtlng.2004.01.002

Fucito, L. M., Juliano, L. M., & Toll, B. A. (2010). Cognitive reappraisal and expressive suppression emotion regulation strategies in cigarette smokers. *Nicotine & Tobacco Research, 12*, 1156-1161. doi: 10.1093/ntr/ntq146

Garrison, G. D., & Dugan, S. E. (2009). Varenicline: A first-line treatment option for smoking cessation. *Clinical Therapeutics, 31*, 465-491. doi:10.1016/j.clinthera.2009.03.021

Gifford, E., Kohlenberg, B. S., Hayes, S. C., Antonuccio, D. O., Piasecki, M. M., Rasmussen-Hall, M. L. & Palm, K. M. (2004). Acceptance-based treatment for smoking cessation. *Behavior Therapy, 35*, 689-705.

Giuliani, N. R., Drabant, E. M., Bhatnagar, R., & Gross, J. J. (2011). Emotion regulation and brain plasticity: Expressive suppression use predicts anterior insula volume. *Neuroimage, 58*, 10–15. doi:10.1016/j.neuroimage.2011.06.028.EMOTION

Gluck, M. E. (2006). Stress response and binge eating disorder. *Appetite, 46*, 26–30. doi:10.1016/j.appet.2005.05.004

Goldstein, M. C. (1998). Bupropion sustained release and smoking cessation. *Journal of Clinical Psychiatry, 59,* S4, 66-72.

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38,* 69-119. doi: 10.1016/S0065-2601(06)38002-1

Gonzalez, A., Vujanovic, A. A., Johnson, K. A., Leyro, T. M., & Zvolensky, M. J. (2009). The role of mindful attention in regard to the relation between negative affect outcome expectancies and emotional vulnerability among adult cigarette smokers. *Cognitive Therapy & Research, 33*, 645-656. doi:10.1007/s10608-009-9246-x

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the Difficulties in Emotion Regulation Scale. *Journal of Psychopathology & Behavioral Assessment, 26*, 41-54.

Gratz, K. L., Tull, M. T., & Wagner, A. W. (2005). Applying DBT mindfulness skills to the treatment of clients with anxiety disorders. In S. M. Orsillo & L. Roemer (Eds.), *Acceptance and mindfulness-based approaches to anxiety: Series in anxiety and related disorders*, pp. 147-161. New York: Springer.

Gross, J.J., & John, O.P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality & Social Psychology, 85*, 348-362.

Gross, J. J., & Levenson, R. W. (1993). Emotional suppression: Physiology, self-report, and expressive behavior. *Journal of Personality & Social Psychology, 64*, 970–986.

Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting positive and negative emotions. *Journal of Abnormal Psychology, 106*, 95–103.

Gross, T. M., Jarvik, M. E., Rosenblatt, M.R. (1993). Nicotine abstinence produces content-specific Stroop interference. *Psychopharmacology, 110*, 333–336.

Gwaltney, C.J., Shiffman, S., Norman, G.J., Paty, J.A., Kassel, J.D., Gnys, M., Hickox, M., Waters, A., & Balabanis, M. (2005). Does smoking abstinence self-efficacy vary across situations? Identifying context-specificity within the relapse situation efficacy questionnaire. *Journal of Consulting and Clinical Psychology, 69,* 516-527.

Gyurak, A., Gross, J. J., & Etkin, A. (2011). Explicit and implicit emotion regulation: A dual-process framework. *Cognition & Emotion, 25*, 400–12. doi:10.1080/02699931.2010.544160

Haaga, D. A. F., Thorndike, F. P., Friedman-Wheeler, D. G., Pearlman, M. Y., & Wernicke, R. (2004). Cognitive coping skills and depression vulnerability among cigarette smokers. *Addictive Behaviors, 29,* 1109-1122.

Haddock, C. K., Lando, H., Klesges, R. C., Talcott, G. W., & Renaud, E. A. (1999). A study of the psychometric and predictive properties of the Fagerström Test for Nicotine Dependence in a population of young smokers. *Nicotine & Tobacco Research, 1*, 59-66.

Hamilton, N. A., Karoly, P., Gallagher, M., Stevens, N., Karlson, C., & McCurdy, D. (2009). The assessment of emotion regulation in cognitive context: The Emotion Amplification and Reduction Scales. *Cognitive Therapy & Research*, *33*, 255–263. doi:10.1007/s10608-007-9163-9

Harrison, A., Genders, R., Davies, H., Treasure, J., & Tchanturia, K. (2010). Experimental measurement of the regulation of anger and aggression in women with anorexia nervosa. *Clinical Psychology & Psychotherapy*, *18*, 445–452. doi:10.1002/cpp.726

Hayes, S.C., Strosahl, K., & Wilson, K.G. (1999). *Acceptance and Commitment Therapy: An experimental approach to behavior change*. New York: Guilford Press.

Heatherton, T. F., & Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin*, *110*, 86–108.

Heatherton, T.F., Koslowski, L.T., Frecker, R.C., and Fagerström, K.O. (1991). The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. *British Journal of Addiction, 86,* 1119-1127.

Hedeker, D., Mermelstein, R. J., Berbaum, M. L., & Campbell, R. T. (2009). Modeling mood variation associated with smoking: An application of a heterogeneous mixed-effects model for analysis of ecological momentary assessment (EMA) data. *Addiction, 104,* 297–307. doi:10.1111/j.1360-0443.2008.02435.x

Hilbert, A., & Tuschen-Caffier, B. (2007). Maintenance of binge eating through negative mood: A naturalistic comparison of Binge Eating Disorder and Bulimia Nervosa. *International Journal of Eating Disorders, 40*, 521–530. DOI 10.1002/eat

Hofmann, S. G., Heering, S., Sawyer, A. T., & Asnaani, A. (2009). How to handle anxiety: The effects of reappraisal, acceptance, and suppression strategies on anxious arousal. *Behaviour Research & Therapy*, *47*, 389–394. doi:10.1016/j.brat.2009.02.010.How

Hofmann, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting & Clinical Psychology, 78*, 169–183. doi:10.1037/a0018555.The

Hohlstein, L. A., Smith, G. T., & Atlas, J. G. (1998). An application of expectancy theory to eating disorders: Development and validation of measures of eating and dieting expectancies. *Psychological Assessment*, *10*, 49–58. doi:10.1037/1040-3590.10.1.49

Hooper, N., Sandoz, E. K., Ashton, J., Clarke, A., & McHugh, L. (2012). Comparing thought suppression and acceptance as coping techniques for food cravings. *Eating Behaviors*, *13*, 62–64. doi:10.1016/j.eatbeh.2011.10.002

John, O.P., & Gross, J.J. (2004). Healthy and unhealthy emotion regulation: Personality processes, individual differences, and lifespan development. *Journal of Personality, 72*, 1301-1334.

Johnson, F., Pratt, M., & Wardle, J. (2012). Dietary restraint and self-regulation in eating behavior. *International Journal of Obesity, 36*, 665–74. doi:10.1038/ijo.2011.156

Johnson, K. A., Zvolensky, M. J., Marshall, E. C., Gonzalez, A., Abrams, K., & Vujanovic, A. A. (2008). Linkages between cigarette smoking outcome expectancies and negative emotional vulnerability. *Addictive Behaviors, 33*, 1416–1424. doi:10.1016/j.addbeh.2008.05.001

Kabat-Zinn, J., Massion, A. O., Kristeller, J., Peterson, L. G., Fletcher, K. E., Pbert, L., Lenderking, W. R., & Santorelli, S. F. (1992). Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *American Journal of Psychiatry, 149*, 936-943.

Kamarck, T. W., & Lichtenstein, E. (1988). Program adherence and coping strategies as predictors of success in a smoking treatment program. *Health Psychology, 7*, 557–574.

Kassel, J. D., Stroud, L. R., & Paronis, C. A. (2003). Smoking, stress, and negative affect: Correlation, causation, and context across stages of smoking. *Psychological Bulletin, 129,* 270–304.

Kassel, J. D., Veilleux, J. C., Wardle, M. C., Yates, M. C., Greenstein, J. E., Evatt, D. P., & Roesch, L. L. (2007) Negative affect and addiction. In M. al'Absi (Ed.), *Stress*

and Addiction: Biological and psychological mechanisms (pp. 171-189). San Diego, CA: Elsevier Academic Press.

Kassirer, J. P., & Angell, M. (1998). Losing weight — An ill-fated New Year's resolution. *New England Journal of Medicine, 338*, 52-54.

Kaye, W. H., Frank, G. K., Bailer, U. F., Henry, S. E., Meltzer, C. C., Price, J. C., … & Wagner, A. (2005). Serotonin alterations in anorexia and bulimia nervosa: New insights from imaging studies. *Physiology & Behavior*, *85*, 73–81. doi:10.1016/j.physbeh.2005.04.013

Kelly, N. R., Lydecker, J. A., & Mazzeo, S. E. (2012). Positive cognitive coping strategies and binge eating in college women. *Eating Behaviors*, *13*, 289–292. doi:10.1016/j.eatbeh.2012.03.012

Klockars, A. J., & Sax, G. (1986). *Multiple comparisons: Quantitative applications in the social sciences.* Newbury Park, CA: Sage Publications.

Kober, H., Kross, E. F., Mischel, W., Hart, C. L., & Oschner, K. N. (2010). Regulation of craving by cognitive strategies in cigarette smokers. *Drug & Alcohol Dependence, 106,* 52-55. doi:10.1016/j.drugalcdep.2009.07.017

Konttinen, H., Männistö, S., Sarlio-Lähteenkorva, S., Silventoinen, K., & Haukkala, A. (2010). Emotional eating, depressive symptoms and self-reported food consumption: A population-based study. *Appetite*, *54*, 473–479. doi:10.1016/j.appet.2010.01.014

Koo-Loeb, J. H., Pedersen, C., & Girdler, S. S. (1998). Blunted cardiovascular and catecholamine stress reactivity in women with bulimia nervosa. *Psychiatry Research*, *80*, 13–27. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9727960

Kotlyar, M., Brauer, L. H., al'Absi, M., Adson, D. E., Robiner, W., Thuras, P.,…& Hatsukami, D. K. (2006). Effect of bupropion on physiological measures of stress in smokers during nicotine withdrawal. *Pharmacology, Biochemistry and Behavior, 83*, 370–379. doi:10.1016/j.pbb.2006.02.017

Kotlyar, M., Golding, M., Hatsukami, D. K., & Jamerson, B. D. (2001). Effect of Nonnicotine pharmacotherapy on smoking behavior. *Pharmacotherapy, 21*, 1530-1548.

Kreek, M. J., & Koob, G. F. (1998). Drug dependence: Stress and dysregulation of brain reward pathways. *Drug and Alcohol Dependence, 51*, 23-47.

Kristeller, J. L., & Hallett, C. B. (1999). An exploratory study of a meditation-based intervention for Binge Eating Disorder. *Journal of Health Psychology*, *4*, 357–63. doi:10.1177/135910539900400305

Kühn, S., Gallinat, J., & Brass, M. (2011). "Keep calm and carry on": Structural correlates of expressive suppression of emotions. *PloS one*, *6*(1), 1–4. doi:10.1371/journal.pone.0016569

Larsen, J. K., van Strien, T., Eisinga, R., & Engels, R. C. M. E. (2006). Gender differences in the association between alexithymia and emotional eating in obese individuals. *Journal of Psychosomatic Research*, *60*, 237–243. doi:10.1016/j.jpsychores.2005.07.006

Lavender, J. M., & Anderson, D. A. (2010). Contribution of emotion regulation difficulties to disordered eating and body dissatisfaction in college men. *International Journal of Eating Disorders*, *43*, 352–357. doi:10.1002/eat.20705

Lichtenstein, E., Zhu, S. -H., & Tedeschi, G. J. (2010). Smoking cessation quitlines: An underrecognized intervention success story. *American Psychologist, 65*, 252-261. doi: 10.1037/a0018598

Linehan, M. M. (1993). *Cognitive-behavioral treatment of borderline personality disorder.* New York, NY: Guilford Press.

Litvin, E. B., Kovacs, M. A., Hayes, P. L., & Brandon, T. H. (2012). Responding to tobacco craving: Experimental test of acceptance versus suppression. *Psychology of Addictive Behaviors, 26*, 830-837. doi: 10.1037/a0030351

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck

Depression and Anxiety Inventories. *Behaviour Research & Therapy, 33*, 335-343.

Lumley, M. A., Downey, K., Stettner, L., Wehmer, F., & Pomerleau, O. F. (1994). Alexithymia and negative affect: Relationship to cigarette smoking, nicotine dependence, and smoking cessation. *Psychotherapy & Psychosomatics, 61*, 156-162. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8066152

Lust, K., Ehlinger, E. P., & Golden, D. (2006). *College health report: Tobacco, alcohol, and other drug use at Minnesota colleges and universities.* Minneapolis, MN: Boynton Health Service.

Lust, K., Ehlinger, E. P., & Golden, D. (2010). *Health and health-related behaviors, University of Minnesota–Twin Cities students.* Minneapolis, MN: Boynton Health Service.

Magar, E. C. E., Phillips, L. H., & Hosie, J. A. (2008). Self-regulation and risk-taking. *Personality & Individual Differences, 45*, 153–159. doi:10.1016/j.paid.2008.03.014

Marlatt, G. A., & Gordon, J. R. (Eds.). (1985). *Relapse prevention: Maintenance strategies in the treatment of addictive behaviors.* New York: Guilford Press.

Marlatt, G. A., & Witkiewitz, K. (2005). Relapse prevention for alcohol and drug problems. In G. A. Marlatt & D. M. Donovan (Eds.), *Relapse prevention: Maintenance strategies in the treatment of addictive behaviors* (2nd ed., pp. 1-44). New York: Guilford Press.

Mathes, W. F., Brownley, K. A., Mo, X., & Bulik, C. M. (2009). The biology of binge eating. *Appetite, 52*, 545–553. doi:10.1016/j.appet.2009.03.005

Mauss, I. B., & Gross, J. J. (2004). Emotion suppression and cardiovascular disease: Is hiding feelings bad for your heart? In I. Nyklicek, L. Temoshok, & A. Vingerhoets, (Eds). *Emotional expression and health: Advances in theory, assessment and clinical applications,* (pp. 60-80). New York, NY: Brunner-Routledge.

Max, W., Rice, D.P., Sung, H-Y., Zhang, L.S., & Miller, L.S. (2004). The economic burden of smoking in California. *Tobacco Control, 13*, 264-267.

McCallum, K. (2010). The case for integrating mindfulness in the treatment of eating disorders. In M. Maine, B. H. McGilley, & D. W. Bunnell (Eds.), *Treatment of Eating Disorders: Bridging the Research - Practice Gap* (pp. 387–403). London, UK: Elsevier.

McGinnis, J.M., & Foege, W.H. (1993). Actual causes of death in the United States. *Journal of the American Medical Association, 270,* 2207-2212.

McMahon, S.D. & Jason, L.A. (1998). Stress and coping in smoking cessation: A longitudinal examination. *Anxiety, Stress, & Coping, 11*, 327-343.

Mermelstein, R. (2003). Teen smoking cessation. *Tobacco Control, 12*, 25-34. doi:10.1136/tc.12.suppl_1.i25

Miller, L.S., Zhang, X., Rice, D.P., & Max, W. (1998). State estimates of total medical expenditures attributable to cigarette smoking, 1993. *Public Health Reports, 113,* 447-458.

Minnesota Department of Health. (2011). *Minnesota adult tobacco survey: Tobacco use in Minnesota, 2010 update*. Retrieved from http://www.health.state.mn.us/divs/chs/tobacco/adult.html

Moghaddam, N. G., & Ferguson, E. (2007). Smoking, mood regulation, and personality: An event-sampling exploration of potential models and moderation. *Journal of Personality, 75*, 451-478.

Mokdad, A.H., Marks, J.S., Stroup, D.F., & Gerberding, J.L. (2004). Actual causes of death in the United States, 2000. *Journal of the American Medical Association, 291*, 1238-1245.

Moore, S. A., Zoellner, L. A., & Mollenholt, N. (2008). Are expressive suppression and cognitive reappraisal associated with stress-related symptoms? *Behaviour Research & Therapy, 46*, 993–1000. doi:10.1016/j.brat.2008.05.001

Munsch, S., Meyer, A. H., Quartier, V., & Wilhelm, F. H. (2012). Binge eating in binge eating disorder: A breakdown of emotion regulatory process? *Psychiatry Research*, *195*, 118–124. doi:10.1016/j.psychres.2011.07.016

Muraven, M. (2010). Practicing self-control lowers the risk of smoking lapse. *Psychology of Addictive Behaviors, 24,* 446–452. doi: 10.1037/a0018545

Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as limited resource: Regulatory depletion patterns. *Journal of Personality & Social Psychology, 74*, 774–789. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9523419

Murphy, R., Straebler, S., Cooper, Z., & Fairburn, C. G. (2010). Cognitive behavioral therapy for eating disorders. *Psychiatric Clinics of NA*, *33*, 611–627. doi:10.1016/j.psc.2010.04.004

Nezlek, J. B., & Kuppens, P. (2008). Regulating positive and negative emotions in daily life. *Journal of Personality*, *76*, 561–80. doi:10.1111/j.1467-6494.2008.00496.x

Niaura, R., Shadel, W. G., Britt, D. M., & Abrams, D. B. (2002). Response to social stress, urge to smoke, and smoking cessation. *Addictive Behaviors, 27*, 241-250.

Niedenthal, P. M., Halberstadt, J. B., & Setterlund, M. B. (1997). Being happy and seeing "happy": Emotional state mediates visual word recognition. *Cognition & Emotion, 11*, 403–432.

Nolen-Hoeksema, S. (2012). Emotion regulation and psychopathology: The role of gender. *Annual Review of Clinical Psychology*, *8*, 161–187. doi:10.1146/annurev-clinpsy-032511-143109

Nolen-Hoeksema, S., & Aldao, A. (2011). Gender and age differences in emotion regulation strategies and their relationship to depressive symptoms. *Personality & Individual Differences, 51*, 704–708. doi:10.1016/j.paid.2011.06.012

O'Connell, K. A., Schwartz, J. E., & Shiffman, S. (2008). Do resisted temptations during smoking cessation deplete or augment self-control resources? *Psychology of Addictive Behaviors, 22,* 486–495.

O'Connor, D. B., Jones, F., Conner, M., McMillan, B., & Ferguson, E. (2008). Effects of daily hassles and eating style on eating behavior. *Health Psychology, 27*(1S), S20-S31. doi: 10.1037/0278-6133.27.1(Suppl.).S20

Oliver, G., & Wardle, J. (1999). Perceived effects of stress on food choice. *Physiology & Behavior*, *66*, 511–515. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10357442

Oliver, G., Wardle, J., & Gibson, E. L. (2000). Stress and food choice: A laboratory study. *Psychosomatic Medicine*, *62*, 853–865. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11139006

Orsillo, S. M., Roemer, L., Block-Lerner, J., LeJeune, C., & J.D. Herbert, J. D. (2004). ACT with anxiety disorders. In S.C. Hayes & K.D. Strosahl (Eds.), *A practical guide to Acceptance and Commitment Therapy* (pp. 103-132). New York: Springer.

Perkins, K. A, Karelitz, J. L., Giedgowd, G. E., & Conklin, C. A. (2013). Negative mood effects on craving to smoke in women versus men. *Addictive Behaviors, 38*, 1527–1531. doi:10.1016/j.addbeh.2012.06.002

Petrie, K. J., Booth, R. J., & Pennebaker, J. W. (1998). The immunological effects of thought suppression. *Journal of Personality & Social Psychology, 75*, 1264-1272. doi: 10.1037/0022-3514.75.5.1264

Piasecki, T. M., Fiore, M. C., McCarthy, D. E., & Baker, T. B. (2002). Have we lost our way? The need for dynamic formulations of smoking relapse proneness. *Addiction, 97*, 1093-1108. doi: 10.1046/j.1360-0443.2002.00216.x

Piper, M. E., & Curtin, J. J. (2006). Tobacco withdrawal and negative affect: An analysis of initial emotional response intensity and voluntary emotion regulation. *Journal of Abnormal Psychology, 115*, 96–102.

Piper, M. E., Cook, J. W., Schlam, T. R., Jorenby, D. E., & Baker, T. B. (2011). Anxiety diagnoses in smokers seeking cessation treatment: Relations with tobacco dependence, withdrawal, outcome and response to treatment. *Addiction, 106*, 418–427. DOI: 10.1111/j.1360-0443.2010.03173.x

Polivy, J., & Herman, C. P. (2002). Causes of eating disorders. *Annual Review of Psychology, 53*, 187–213.

Pomerleau, C. S., Pomerleau, O. F., McPhee, K., & Morrell, E. M. (1990). Discordance of physiological and biochemical response to smoking and to psychological stress. *British Journal of Addiction, 85*, 1309–1316.

Pomerleau, C. S., Carton, S. M., Lutzke, M. L., Flessland, K. A., & Pomerleau, O. F. (1994). Reliability of the Fagerström Tolerance Questionnaire and the Fagerstrom Test for Nicotine Dependence. *Addictive Behaviors, 19*, 33-39.

Pomerleau ,O. F., Adkins, D., & Pertschuk, M. (1978). Predictors of outcome and recidivism in smoking cessation treatment. *Addictive Behaviors, 3*, 65-70.

Pomerleau , O. F., & Pomerleau , C. S. (1991). Research on stress and smoking: Progress and problems. *British Journal of Addiction, 86*, 599-603

Proulx, K. (2012). Experiences of women with bulimia nervosa in a mindfulness-based eating disorder treatment group. *Eating Disorders*, *16*, 52–72. doi:10.1080/10640260701773496

Rabois, D., & Haaga, D. A. F. (2003). The influence of cognitive coping and mood on smokers' self-efficacy and temptation. *Addictive Behaviors, 28,* 561-573.

Rabius, V., Geiger, A., McAlister, A. L., Huang, P., & Todd, R. (2004). Telephone counseling increases cessation rates among young adult smokers. *Health Psychology, 23*, 539-541. doi: 10.1037/0278-6133.23.5.539

Richards, J. M., & Gross, J. J. (2006). Personality and emotional memory: How regulating emotion impairs memory for emotional events. *Journal of Research in Personality, 40*, 631–651. doi:10.1016/j.jrp.2005.07.002

Rothman, A. J., Sheeran, P., & Wood, W. (2009). Reflective and automatic processes in the initiation and maintenance of dietary change. *Annals of Behavioral Medicine, 38*(Suppl1), S4-S17. doi: 10.1007/s12160-009-9118-3

Rottenberg, J., Ray, R. D., & Gross, J. J. (2007). Emotion elicitation using films. In J. A. Coan & J. J. B. Allen (Eds.), *The handbook of emotion elicitation and assessment,* (pp. 9-28). New York: Oxford University Press.

Safer, D. L., Robinson, A. H., & Jo, B. (2010). Outcome from a randomized controlled trial of group therapy for binge eating disorder: Comparing dialectical behavior therapy adapted for binge eating to an active comparison group therapy. *Behavior Therapy, 41*, 106–120. doi:10.1016/j.beth.2009.01.006

Salovey, P., Bedell, B. T., Detweiler, J. B., & Mayer, J. D. (1999). Coping intelligently: Emotional intelligence and the coping process. In C. R. Snyder (Ed.), *Coping: The psychology of what works* (pp. 141-164). New York: Oxford University Press.

Salovey, P., Rothman, A. J., Detweiler, J. B., & Steward, W. T. (2000). Emotional states and physical health. *American Psychologist, 55*, 110-121. doi:10A037//0003-O66X.55.1.110

Sayette, M. A. (2004). Self-regulatory failure and addiction. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 447-465). New York: Guilford Press.

Schachter, S. & Singer, J. E. (1962). Cognitive, social, and physiological determinants of emotional state. *Psychological Review, 69*, 379-399.

Scheier, M. F., & Bridges, M. W. (1995). Person variables and health: Personality predispositions and acute psychological states as shared determinants for disease. *Psychosomatic Medicine, 57*, 255–268. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/7652126

Schlup, B., Munsch, S., Meyer, A. H., Margraf, J., & Wilhelm, F. H. (2009). The efficacy of a short version of a cognitive-behavioral treatment followed by booster sessions for binge eating disorder. *Behaviour Research & Therapy, 47*, 628–635. doi:10.1016/j.brat.2009.04.003

Schulz, S., & Laessle, R. G. (2012). Stress-induced laboratory eating behavior in obese women with binge eating disorder. *Appetite, 58*, 457–461. doi:10.1016/j.appet.2011.12.007

Schur, E. A., Heckbert, S. R., & Goldberg, J. H. (2010). The association of restrained eating with weight change over time in a community-based sample of twins. *Obesity, 18*, 1146–52. doi:10.1038/oby.2009.506

Scott, W. D., Beevers, C. G., & Mermelstein, R. J. (2008). Depression vulnerable and nonvulnerable smokers after a failure experience: Examining cognitive self-regulation and motivation. *Behavior Modification, 32*, 519-539.

Shadel, W. G., & Mermelstein, R. J. (1993). Cigarette smoking under stress: The role of coping expectancies among smokers in a clinic-based smoking cessation program. *Health Psychology, 12*, 443-450.

Shaw, D., & al'Absi, M. (2008). Attenuated beta endorphin response to acute stress is associated with smoking relapse. *Pharmacology, Biochemistry, & Behavior, 90*, 357-362.

Sheppes, G., Scheibe, S., Suri, G., & Gross, J. J. (2011). Emotion-regulation choice. *Psychological Science*, *22*, 1391–1396. doi:10.1177/0956797611418350

Sheppes, G., Scheibe, S., Suri, G., Radu, P., Blechert, J., & Gross, J. J. (2012). Emotion regulation choice: A conceptual framework and supporting evidence. *Journal of Experimental Psychology: General*. doi:10.1037/a0030831

Shiffman, S., & Paty, J. (2006). Smoking patterns and dependence: Contrasting chippers and heavy smokers. *Journal of Abnormal Psychology, 115,* 509–23. doi:10.1037/0021-843X.115.3.509

Shiffman, S. & Waters, A, J. (2004). Negative affect and smoking lapses: A prospective analysis. *Journal of Consulting & Clinical Psychology, 72*, 192-201.

Shiffman, S., Gnys, M., Richards, T. J., Paty, J. A., Hickcox, M., & Kassel, J. D. (1996). Temptations to smoke after quitting: A comparison of lapsers and maintainers. *Health Psychology, 15*, 455-461.

Shiffman, S., Kassel, J. D., Gwaltney, C. & McChargue, D. (2005). Relapse prevention for smokers. In G. A. Marlatt & D. M. Donovan (Eds.), *Relapse prevention: Maintenance strategies in the treatment of addictive behaviors* (2nd ed., pp. 92-129). New York: Guilford Press.

Shmueli, D., & Prochaska, J. J., (2009). Resisting tempting foods and smoking behavior: Implications from a self-control theory perspective. *Health Psychology, 28*, 300–306. doi: 10.1037/a0013826

Siahpush, M., Carlin, J. B. (2006). Financial stress, smoking cessation and relapse: Results from a prospective study of an Australian national sample. *Addiction, 101*, 121-127.

Siervo, M., Wells, J. C. K., & Cizza, G. (2009). The contribution of psychosocial stress to the obesity epidemic. *Hormone & Metabolic Research*, *41*, 261–270. doi:10.1055/s-0028-1119377

Sjoberg, L. & Johnson, T. (1978). Trying to give up smoking: A study of volitional breakdown. *Addictive Behaviors, 3*, 149-64.

Skinner, E. A., Edge, K., Altman, J., & Sherwood, H. (2003). Searching for the structure of coping: A review and critique of category systems for classifying ways of coping. *Psychological Bulletin, 129,* 216-269.

Smyth, J. M., Wonderlich, S. A., Heron, K. E., Sliwinski, M. J., Crosby, R. D., Mitchell, J. E., & Engel, S. G. (2007). Daily and momentary mood and stress are associated with binge eating and vomiting in bulimia nervosa patients in the natural environment. *Journal of Consulting & Clinical Psychology*, *75*, 629–38. doi:10.1037/0022-006X.75.4.629

Soulakova, J. N., Hartman, A. M., Liu, B., Willis, G. B., & Augustine, S. (2012). Reliability of adult self-reported smoking history: Data from the tobacco use supplement to the current population survey 2002-2003 cohort. *Nicotine & Tobacco Research, 14,* 952–960. doi:10.1093/ntr/ntr313

Spoor, S. T. P., Bekker, M. H. J., van Strien, T., & van Heck, G. L. (2007). Relations between negative affect, coping, and emotional eating, *Appetite, 48*, 368-376. doi:10.1016/j.appet.2006.10.005

Sproesser, G., Strohbach, S., Schupp, H., & Renner, B. (2011). Candy or apple? How self-control resources and motives impact dietary healthiness in women. *Appetite*, *56*, 784–787. doi:10.1016/j.appet.2011.01.028

Svaldi, J., Tuschen-Caffier, B., Lackner, H. K., Zimmermann, S., & Naumann, E. (2012). The effects of emotion regulation on the desire to overeat in restrained eaters. *Appetite, 59*, 256–263. doi:10.1016/j.appet.2012.04.016

Swan, G. E., Ward, M. M., Jack, L. M., & Javitz, H. S. (1993). Cardiovascular reactivity as a predictor of relapse in male and female smokers. *Health Psychology, 12*, 451-458.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*, 5th ed. Boston: Allyn & Bacon.

Tamir, M. Srivastava, S., John, O. P., & Gross, J. J. (2007). Implicit theories of emotion: Affective and social outcomes across a major life transition. *Health Psychology, 92,* 731-744.

Taut, D., Renner, B., & Baban, A. (2012). Reappraise the situation but express your emotions: Impact of emotion regulation strategies on ad libitum food intake. *Frontiers in Psychology, 3*(359), 1–7. doi:10.3389/fpsyg.2012.00359

Teasdale, J. D. (1999). Metacognition, mindfulness and the modification of mood disorders. *Clinical Psychology & Psychotherapy, 6*, 146-155.

Telch, C. F. (1997). Skills training treatment for adaptive affect regulation in a woman with binge-eating disorder. *International Journal of Eating Disorders, 22*, 77–81.

Telch, C. F., Agras, W. S., & Linehan, M. M. (2001). Dialectical behavior therapy for binge eating disorder. *Journal of Consulting & Clinical Psychology*, *69*, 1061–1065. doi:10.1037//0022-006X.69.6.1061

Tice, D. M., & Bratslavsky, E. (2000). Giving in to feel good: The place of emotion regulation in the context of general self-control. *Psychological Inquiry, 11*, 149-159.

Tice, D. M., & Bratslavsky, E., & Baumeister, R. F. (2001). Emotional distress regulation takes precedence over impulse control: If you feel bad, do it! *Journal of Personality and Social Psychology, 80*, 53-67. doi: 10.1037//0022-3514.80.1.53

Tiffany, S. T. (1990). A cognitive model of drug urges and drug-use behavior: Role of automatic and nonautomatic processes. *Psychological Review, 97,* 147-168.

Tolchin, M. (1988, May 17). Surgeon General asserts smoking is an addiction. *The New York Times*. Retrieved from http://query.nytimes.com/gst/fullpage.html?res=940DE0DE173EF934A25756C0A96E948260

Toll, B. A., Katulakb, N. A., & McKee, S. A. (2006). Investigating the factor structure of the Questionnaire on Smoking Urges-Brief (QSU-Brief). *Addictive Behavior, 31*, 1231-1239. doi: 10.1016/j.addbeh.2005.09.008

Torres, S. J., & Nowson, C. A. (2007). Relationship between stress, eating behavior, and obesity. *Nutrition, 23*, 887–894. doi:10.1016/j.nut.2007.08.008

Tugend, J. L. (Producer), & Hunt, B. (Director). (2000). *Return to me* [Motion picture]. United States: MGM Studios.

U.S. Department of Health and Human Services (USDHHS). (2010). *The Surgeon General's vision for a healthy and fit nation.* Rockville, MD: U.S. Department of Health and Human Services, Office of the Surgeon General.

van Strien, T., Frijters, J. E. R., Bergers, G. P. a., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders*, *5*, 295–315. doi:10.1002/1098-108X(198602)5:2<295::AID-EAT2260050209>3.0.CO;2-T

Velicer, W.F., DiClemente, C.C., Rossi J.S., & Prochaska, J.O. (1990). Relapse situations and self-efficacy: An integrative model. *Addictive Behaviors, 15,* 271-283.

Vidrine J.I., Businelle, M.S., Cinciripini, P., Li, Y., Marcus, M. T., Waters, A.J., Reitzel, L.R., & Wetter, D.W. (2009). Associations of mindfulness with nicotine dependence, withdrawal, and agency. *Substance Abuse, 30,* 318-327.

Vieten, C., Astin, J. A., Buscemi, R., & Galloway, G. P. (2010). Development of an acceptance-based coping intervention for alcohol dependence relapse prevention. *Substance Abuse, 31*, 108-116. doi: 10.1080/08897071003641594

Vohs, K. D., Baumeister, R. F., Schmeichel, B. J., Twenge, J. M., Nelson, N. M., & Tice, D. M. (2008). Making choices impairs subsequent self-control: A limited-resource

account of decision making, self-regulation, and active initiative. *Journal of Personality & Social Psychology*, *94*, 883–898. doi:10.1037/0022-3514.94.5.883

Vohs, K. D., & Heatherton, T. F. (2000). Self-regulatory failure: A resource-depletion approach. *Psychological Science*, *11*, 249–254. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11273412

Volokhov, R. N., & Demaree, H. A. (2010). Spontaneous emotion regulation to positive and negative stimuli. *Brain & Cognition*, *73*, 1–6. doi:10.1016/j.bandc.2009.10.015

Wadland, W.C., Soffelmayr, B., & Ives, K. (2001). Enhancing smoking cessation of low-income smokers in managed care. *Journal of Family Practice, 50,* 138-144.

Wardle, J. (1987). Eating style: A validation study of the Dutch Eating Behaviour Questionnaire in normal subjects and women with eating disorders. *Journal of Psychosomatic Research*, *31*, 161–169. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3473234

Waters, A. J., Shiffman, S., Bradley, B. P., & Mogg, K. (2003). Attentional shifts to smoking cues in smokers. *Addiction, 98*, 1409–1417.

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 & Social Psychology, 54*, 1063-1070.

Webb, T. L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: A meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological Bulletin*, *138*, 775–808. doi:10.1037/a0027600

Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review, 101*, 34-52.

Wenzlaff, R. M., & Wegner, D. M. (2000). Thought suppression. *Annual Review of Psychology, 51*, 59-91.

Wewers, M. E. (1988). The role of post-cessation factors in tobacco abstinence: Stressful events and coping responses. *Addictive Behaviors, 13,* 297-302.

Wisniewski, L, Safer, D. L., & Chen F. (2007). Dialectical Behavior Therapy for Eating Disorders. In Dimeff, L.A. & Koerner, K (Eds). *Adaptations of Dialectical Behavior Therapy*, (pp. 174-221). NY: Guilford Press.

Witkiewitz, K., Bowen, S., Douglas, H., & Hsu, S. H. (2013). Mindfulness-based relapse prevention for substance craving. *Addictive behaviors*, *38*, 1563–1571. doi:10.1016/j.addbeh.2012.04.001

Wolgast, M., Lundh, L.-G., & Viborg, G. (2011). Cognitive reappraisal and acceptance: An experimental comparison of two emotion regulation strategies. *Behaviour Research & Therapy*, *49*, 858–866. doi:10.1016/j.brat.2011.09.011

Zislis, G., Desai, T. V., Prado, M., Shah, H. P., & Bruijnzeel, A. W. (2007). Effects of the CRF receptor antagonist $_D$-Phe CRF$_{(12—41)}$ and the a2-adrenergic receptor agonist clonidine on stress-induced reinstatement of nicotine-seeking behavior in rats. *Neuropharmacology, 53,* 958-966.

Appendix A

Emotion Regulation Instructions for Movie Clip Emotion Induction
(Based on instructions described by Richards and Gross, 2006)

Control Condition:

You will now be shown a short film clip. It is important that you watch the film clip carefully, but if you find the film too distressing, just press "stop" and let the researcher know.

Suppression Condition:

You will now be shown a short film clip. It is important that you watch the film clip carefully, but if you find the film too distressing, just press "stop" and let the researcher know. If you have any feelings or thoughts as you watch the film clip, please try your best not to let them show. In other words, as you watch the film clip, try to behave in such a way that a person watching you would not know you are feeling or thinking anything. Watch the film carefully, but suppress any reactions you may have so someone watching would not know that you are thinking or feeling anything.

Cognitive Reappraisal Condition:

You will now be shown a short film clip. It is important that you watch the film clip carefully, but if you find the film too distressing, just press "stop" and let the researcher know. If you have any feelings or thoughts as you watch the film clip, please try your best to remind yourself that it is not real by focusing on the technical aspects or reminding yourself that you are watching a scene from a fictional movie with paid actors. Watch the film clip carefully, but remind yourself that the scene is not real.

Mindfulness/Acceptance Condition:

You will now be shown a short film clip. It is important that you watch the film clip carefully, but if you find the film too distressing, just press "stop" and let the researcher know. If you have any feelings or thoughts as you watch the film clip, please try to just notice and accept what you see and what you hear in the clip. If you experience any feelings or thoughts as you watch the clip, do your best to just notice the reactions that you experience, too. Watch the film clip carefully, but notice and accept whatever you see, hear, feel, or think.

Appendix B

Pilot Study: Validation of the Emotion Induction Stimulus and

Emotion Regulation Instructions

The primary aim of the pilot study was to validate the emotion induction protocol and the emotion regulation instructions to ensure that the manipulations used in the subsequent research would be effective. Previous research has demonstrated efficacy in eliciting affective responses using brief film clips (e.g., Rottenberg et al., 2007). Though other studies have successfully used music (e.g., Niedenthal, Halberstadt, & Setterlund, 1997) or expressive writing prompts to elicit desired affective responses, the majority of the literature successfully uses film clips in studies of emotion regulation.

Method

Participants

For the pilot study, $N = 32$ participants, all students in undergraduate psychology courses at a large Midwestern university, completed the study. Participants were mostly between 18 and 21 years old (94%; the remainder were 22-25 years old), and relatively evenly split between women (53%) and men (47%). Half (50%) were Freshmen, 19% were Sophomores, 25% were Juniors, and 6% were Seniors. The majority identified themselves as White/Caucasian (76%), with 12% identifying as African/African American and 12% identifying as Asian/Asian American.

Measures

Pre- emotion-induction measures.

Emotion regulation instructions. Participants were randomly assigned to one of three conditions: suppression, cognitive reappraisal, and mindfulness. Consistent with the standard protocol in other studies of experimentally manipulated emotion regulation strategies (e.g., John & Gross, 2004; Richards & Gross, 2006), participants in the *Suppression* (S) condition were instructed to suppress any emotions or expressions of emotion that came up as they watched the stimulus clip. Similarly, following the approach of Evers and colleagues (2010), participants in the *Cognitive Reappraisal* (CR) condition were asked to remind themselves that it is just a fictional movie with paid actors if any emotions came up as they watched the stimulus clip. The final condition – *Mindfulness/Acceptance* (MA) – had not been previously used in this type of study. The instructions were written based on the principles of mindfulness and acceptance (e.g., Baer, 2003) and to be consistent with the format of the instructions for the other emotion regulation conditions. Participants in the Mindfulness condition were asked to just notice and accept any emotions that came up as they watched the stimulus clip (see Appendix A for emotion regulation instructions).

Emotion induction stimulus. The emotion induction procedure followed that of Gross and colleagues (e.g., Gross & Levenson, 1997; Rottenberg, Ray, & Gross, 2007), using a brief digital clip from a movie. The content of the clip was designed to invoke a moderately intense emotional reaction of negative affect. In previous studies, different types of specific negative affect content (e.g., content evoking sadness, fear, or disgust) have been used, and all have been shown to produce similar effects with regard to emotion regulation (though disgust has been shown to produce some slightly different

responses; see Gross & Levenson, 1993). For this study, I chose to induce sadness, because in previous research sadness has been one of the most consistently induced negative emotions. The selected clip from the movie *Return to Me* (Tugend & Hunt, 2000) was used to induce negative affect (specifically, sadness). In the clip, a man and woman are shown slow dancing at a wedding, before the scene flashes to a fast-paced emergency room in which the woman is covered in blood being raced into the operating room. It concludes by flashing to a scene after her death, in which the man returns home to an empty apartment, where he sits on the floor and sobs to their dog, "She's not coming home."

The clip (length: 213 seconds) was digitally extracted using freeze-frame technology to ensure that the exact desired content was included in the stimulus, and to standardize the stimulus exposure across all participants. Instructions from Rottenberg et al. (2007) were followed to ensure that I used a previously validated emotion induction stimulus. The same movie clip was used as an emotion induction stimulus for all participants. However, participants assigned to different conditions were given different instructions for emotion regulation to follow while watching the clip, as noted above.

Post- emotion-induction measures.

Free response – emotional reactions. Participants were given an empty text box and asked to respond to the prompt *In your own words, please describe any emotional reactions you experienced while watching the movie.* These responses were coded by the research team to identify: 1) if participants explicitly mentioned feeling sad or sadness; 2) if participants used other phrases that indirectly conveyed sadness or closely related

emotions; and 3) if participants did not directly or indirectly report feeling sad in response to the movie clip.

Rating scales – emotional reactions. Participants also completed ratings of the extent to which the scene conveyed eleven different emotions (anger, happiness, sadness, excitement, guilt, humor, enthusiasm, disgust, relaxation, fear, and joy). Responses to these questions were on a 7-point scale from *not at all* (1) to *extremely* (7).

Manipulation check. After completing other outcomes measures, participants were asked to respond free form to the prompt *Please describe everything that was going through your mind while you were watching the movie clip. Please be specific.* Participants were also asked to report the extent to which they used each of the three emotion regulation styles (suppression, cognitive reappraisal, and mindfulness), and the extent to which each of these ER styles helped them to handle any responses they had. For example, one item asked *To what extent did you suppress your reactions and try not to show how you felt?* Responses to all these questions were on a 7-point scale from *not at all* (1) to *extremely* (7).

Procedure

Interested participants contacted the researchers via email. The only eligibility criteria for this study were enrollment in a participating psychology course and being 18 years of age or older. All (except one interested participant who was under age 18) were deemed eligible for participation. A total of $n = 36$ participants were enrolled and given a lab session appointment. At enrollment, participants were randomly assigned to one of three emotion regulation conditions: suppression, cognitive reappraisal, or mindfulness.

Four participants (by condition: suppression $n = 1$, cognitive reappraisal $n = 1$, mindfulness $n = 2$) did not show for their scheduled appointments, and did not respond to follow up invitations to reschedule. Thus, a total $n = 32$ individuals participated in the pilot study, resulting in the following distribution: suppression ($n = 11$), mindfulness ($n = 10$), and cognitive reappraisal ($n = 11$).

Participants came into the lab individually. After reviewing the consent form and asking any questions they might have, participants were given the emotion regulation instructions that matched their assigned condition, and were asked to follow these instructions while watching the movie clip. Participants then watched the movie clip and were asked to report their thoughts, complete manipulation check questions, report their emotional reactions, and rate the extent to which the clip conveyed a number of different emotions. The main purposes of this study were 1) to verify that the emotion induction stimulus produced the desired emotional response of sadness; and 2) to verify that the emotion regulation instructions for each condition resulted in participants actually following the instructions.

Results

Validation of the Emotion Regulation Instructions

Hypothesis 1. Participants will report using the emotion regulation strategy that matches the emotion regulation condition to which they were assigned, more than participants assigned to other conditions. This was a manipulation check to confirm that participants actually used the emotion regulation strategy that was assigned. The results showed that participants in each emotion regulation condition did use the

matching strategy more than participants in the other conditions. Specifically, participants in the Suppression condition reported using suppression significantly more than did participants in the Mindfulness or Cognitive Reappraisal conditions. The data also showed a trend such that participants in the Mindfulness condition reported using mindfulness more than did participants in the Suppression condition and Cognitive Reappraisal conditions, though those in the Reappraisal condition reported using mindfulness nearly as much as those in the Mindfulness condition. Lastly, participants in the Cognitive Reappraisal condition reported using cognitive reappraisal significantly more than did participants in the Suppression or Mindfulness conditions (see Table 5 for more detailed results).

Validation of the Emotion Induction Stimulus

Hypothesis 2. Participants will report sadness as the primary emotional response to the movie clip. The aim of these analyses was to ensure that the emotion induction activity (watching the selected movie clip) did in fact consistently produce the expected emotional activation for sadness.

Hypothesis 2a. Participants will spontaneously report sadness when asked to free respond to a prompt for any emotional reactions to the movie clip. Twenty-six participants (81.25%) explicitly used the word *"sad"* or *"sadness"* in their free response text. One participant conveyed a sense of intense sadness, calling the movie clip *"heart-wrenching"*. Three participants reported *"feeling bad for the guy"*. Only two (6.25%) of the 32 participants did not spontaneously directly or indirectly report sadness in the free response.

Hypothesis 2b. Participants will endorse higher levels of sadness than any of

the other emotions on the rating scale. Participants did report that the movie clip

conveyed high levels of sadness (M = 6.38, SD = .79). All participants rated sadness 4 or

higher on the seven-point scale. The mean levels reported for the other ten emotions were

notably lower, ranging from humor (M = 1.44, SD = 1.05) to happiness (M = 4.16, SD =

1.42).

Discussion

The results of the pilot study indicated that this movie clip from *Return to Me* was

an effective emotion induction for sadness in this population. The results were consistent

with the previous literature, as this clip has been validated and used by others to induce

negative affect (e.g., Gross & Levenson, 1997; Rottenberg et al. 2007). The goal of

confirming the efficacy of this stimulus within the same population from which the Study

1 sample would be drawn was achieved.

Secondly, the results of the pilot study indicated that the emotion regulation

instructions, including the instructions for the mindfulness condition that were developed

for this project, produced the desired outcome, at least via self-reported use of emotion

regulation strategies. In other words, participants assigned to use a particular emotion

regulation strategy reported using that strategy more than did participants in other

conditions.

In conclusion, these pilot data validate that the emotion induction procedure was

effective in producing negative affect in the target population, and, at least by self-report,

the emotion regulation instructions were effective in getting people to use the assigned

emotion regulation strategy. These same emotion induction and emotion regulation

instruction methods were used with confidence in Study 1.

Appendix C

Empirical Review of Stress and Smoking

Converging research from multiple lines of work demonstrates that stress is associated with increased rates of smoking as well as higher risk of relapse to smoking. Smokers report higher levels of stress than non-smokers (Froelicher et al., 2004; McMahon & Jason, 1998). People who have experienced higher levels of social stressors, including financial stressors (Siahpush & Carlin, 2006), racism/discrimination (Fernander & Schumacher, 2008), and lower socioeconomic status (Adler et al., 1994; Fernander & Schumacher, 2008) also smoke or relapse at higher rates than those who have not. Smokers frequently name stress as an explanation for relapse (e.g., Pomerleau et al., 1990). Longitudinal studies have shown that a decrease in stress post-cessation is associated with maintaining cessation (Cohen & Lichtenstein, 1990; McMahon & Jason, 1998).

Overall, the experimental literature on smoking and stress supports the relation between stress and smoking. Specifically, exposure to stressors is typically associated with greater urges to smoke and higher rates of smoking. For example, Pomerleau and Pomerleau (1991) noted that smokers who were exposed to stress in any of a number of different forms (e.g., loud noise to simulate an airplane, social performance tasks) increased their rate of smoking compared to controls. They further discussed evidence that plasma levels of nicotine deplete more rapidly in smokers exposed to stressors, compared to controls. These results suggest that smokers under stress must smoke more (or more often) to maintain the same levels of plasma nicotine.

Other physiological findings also support an association between stress and smoking. Smokers who were more reactive to social stressors (in terms of heart rate increase) were less likely to have quit at follow-up (Niaura, Shadel, Britt, & Abrams, 2002). Others have also identified differences in cardiovascular reactivity between those who later quit or relapsed (Emmons, Weidner, & Collins, 1989), although specific cardiovascular indicators of later relapse differed for men and women (Swan, Ward, Jack, & Javitz, 1993). Those who subsequently relapsed also showed decreased neurobiological response to exposure to a psychosocial stressor (e.g., appropriate stress activation responses are blunted; Shaw & al'Absi, 2008; al'Absi, 2006; see also Kreek & Koob, 1998 for a review of research on stress, neurobiology, and addiction). Further, although noting the same blunted stress reaction, Dagher and colleagues (2009) found increased reactivity when subsequently exposed to smoking-related cues; the extent of the blunted response to stress was positively correlated with subsequent heightened response to smoking cues.

These findings suggest that individuals who go on to relapse physiologically and biochemically respond differently to daily stressors and are more responsive to smoking cues, suggesting possible mechanisms by which exposure to stress may influence smoking behavior in some people. Similarly, findings from animal models also demonstrate that exposure to a stressor reinstates nicotine-seeking behavior in rodents in which nicotine-seeking has been conditioned and extinguished (Bilkei-Gorzo et al., 2007), particularly in a subset of highly stress-reactive animals (Zislis, Desai, Prado, Shah, & Bruijnzeel, 2007).

The evidence to date suggests that, in smokers, stress is associated with physiological and affective changes that promote urges to smoke, and increase likelihood of relapse in smokers who have quit. These effects may be particularly impactful for a subset of people who are more vulnerable or reactive to stress, such as people with depression, anxiety, or difficulty in coping or regulating their reactions to stress. Abrams and colleagues (Abrams et al., 1987, 1988) have found that relapsers, compared to quitters, had significantly higher anxiety and performed more poorly in negative mood situations. More recently, in a study of smokers who also have post-traumatic stress disorder (PTSD), smokers who had never been able to successfully quit smoking for 7 days showed higher levels of emotional reactivity to everyday stressors and personalized trauma scripts (Calhoun et al., 2007).

Appendix D

Empirical Review of Negative Affect and Smoking

Negative affect (NA) and relapse often co-occur in addiction, so much so that

Kassel and colleagues (2007, p. 176) noted that, "Negative affect appears to be the

common denominator to withdrawal syndromes across all addictive substances." The

relation between NA and increased risk of relapse appears to hold true for individuals in

clinical as well as nonclinical populations. Individuals with any lifetime anxiety or

depression diagnosis smoke at higher rates than the general population, and when

quitting, have significantly higher rates of relapse (Piper, Cook, Schlam, Jorenby, &

Baker, 2011). Some depressive symptoms, particularly anhedonia, are predictive of later

relapse (Cook, Spring, McChargue, & Doran, 2010). Additionally, following a lapse,

depressed individuals experienced more negative affect and less motivation to quit

compared to non-depressed individuals (Scott, Beevers, & Mermelstein, 2008).

Kassel, Shiffman, and their colleagues (Kassel et al., 2007; Kassel, Stroud, &

Paronis, 2003; Shiffman, Kassel, Gwaltney, & McChargue, 2005) have found that, in

general, self-reported negative affect has been reliably associated with smoking and

difficulty quitting smoking (Kassel et al., 2007; Kassel et al., 2003). Smokers

prospectively reporting that negative affect situations are when they are most likely to

smoke have higher rates of relapse after a later quit attempt (Pomerleau et al., 1978).

Similarly, smokers who experience greater negative affect in the presence of smoking

cues show more impulsivity (Doran, Cook, McChargue, Myers, & Spring, 2008), which

may increase likelihood of lapse in the presence of smoking cues. Similarly, Scott and

colleagues (2008) found that participants with a history of depression experienced more negative affect and less motivation for cessation following a lapse; no differences were found prior to lapse, suggesting that these individuals were able to initiate a quit successfully, but struggled with relapse prevention and maintenance.

In an attempt to resolve concerns about motivated retrospective reporting (i.e., smokers who relapsed retrospectively reporting more negative affect to justify their relapse [to themselves or to others]), Shiffman and Waters (2004) used EMA methodology to prospectively test whether negative affect temporally preceded and predicted smoking. They found that NA on the previous day did not predict smoking, but same-day NA was elevated up to several hours prior to the lapse to smoking.

Affective Processing Model: Negative Reinforcement and Smoking

Evidence that smoking actually relieves negative mood is limited, with most research suggesting that expectancies for mood improvement and relief of negative mood are linked to smoking behavior (e.g., Brandon, Wetter, & Baker, 1996) but that actual pre- to post- smoking improvements in mood are not found (e.g., Moghaddam & Ferguson, 2007; but see Hedeker, Mermelstein, Berbaum, & Campbell, 2009).

One proposed explanation from Baker and colleagues (2004) for the integral role of NA in addiction highlights two key findings from animal and human addictions research. First, NA due to interoceptive withdrawal cues is typically alleviated by substance use; this association generalizes swiftly and persistently to NA due to other (e.g., psychosocial, physiological stress) causes, facilitating development and maintenance of expectancies for NA relief from substance use. Secondly, NA secondary

to stress is sometimes reduced by substance use (this is more or less likely depending on the substance used and the contextual circumstances), which can also contribute to NA reduction expectancies. Finally, these two factors may have additive effects. This framework for considering the role of negative affect in maintenance of smoking suggests the potential importance of providing psychoeducation during the cessation process about the similarity of withdrawal and negative affect, as well as other interventions to increase skills or use of skills for coping with negative affect.

Appendix E

Original Anticipated Purpose and Method of Study 2

Due to difficulties with recruitment and retention in Study 2, insufficient

participants were retained through the originally planned lab session, described below.

Original Purpose of Study 2

Study 2 focuses primarily on further differentiating the effects of several types of

emotion regulation strategies in smokers. This study can contribute to the literature in this

area in several ways. First, few controlled, lab-based studies have experimentally

examined the impact of different emotion-regulation strategies on smoking or cravings to

smoke. Studies that have examined emotion regulation have typically focused on just one

emotion regulation approach. For example, Fucito and colleagues (2010) reported on the

detrimental effects of suppression on ability to regulate smoking. Others have noted the

benefits of some cognitive strategies in regulating smoking, such as focusing on long-

term (future health) versus short-term (immediate enjoyment) consequences of smoking

(Kober et al., 2010) or using cognitive coping skills (Haaga et al., 2004). Only one study

experimentally compared the impact of different emotion regulation strategies on

smoking (suppression versus reappraisal in smokers; Fucito et al., 2010).

Secondly, some existing studies that have examined stress management or

mindfulness-based emotion regulation approaches for smoking or eating have done so in

clinical interventions, which by design inherently provide more external validity for

clinical use, but less experimental control and internal validity for testing causal relations,

compared to brief lab-based manipulations. For example, in their smoking cessation

intervention study D'Angelo and colleagues (2005) noted that less than 50% of participants in their stress management condition attended enough sessions to be considered adhering to the treatment condition.

Lastly, though mindfulness and acceptance-based (MA) strategies for emotion regulation have been theoretically linked to improvements in self-regulation of smoking behavior (Carmody et al., 2007), only a few studies have tested clinical mindfulness or acceptance interventions for smoking. More importantly, to my knowledge, there are as yet no laboratory studies of the effects of mindfulness or acceptance-based emotion-regulation techniques on cravings or smoking behavior. Only one study was identified that experimentally examined mindfulness in smokers in a controlled setting; however, this study focused on the effect of the interaction between mindfulness and expectancies for negative affect reduction from smoking on anxiety and emotion (Gonzalez et al., 2009), and does not directly address the current questions.

In summary, Study 2 aimed to experimentally test the effects of three different emotion regulation strategies (Suppression, Reappraisal, and Mindfulness) on distress, negative affect, urges to smoke, and performance on a smoking Stroop task. I predicted that Reappraisal and Mindfulness would both be similarly associated with lower urges to smoke and decreased latency on the smoking Stroop task, and with lower levels of distress and negative affect. In contrast, Suppression would be associated with greater urges to smoke and increased latency on the smoking Stroop task, as well as more distress and negative affect.

Lab Session Procedure

To reduce any priming effects from the baseline questionnaires, participants were asked to come into the lab individually for the one-hour lab session approximately one week after completing the initial online assessments. Participants came into the lab individually for one session (T2). In line with other lab studies of this nature, all participants were asked to refrain from smoking for two hours prior to attending the T2 lab session to achieve an initial state of mild craving or absence of nicotine satiation. Upon arrival, participants were first asked to report time of last cigarette, as well as complete measures of mood, distress, and cravings.

Participants were randomly assigned to one of four emotion regulation conditions: suppression, cognitive reappraisal, mindfulness/acceptance, and a control group. Participants watched a brief digital clip from a movie (approximately 2-4 minutes) designed to induce negative affect. This stimulus was consistent across all participants; however, participants were given different instructions for emotion regulation. Prior to the negative mood induction, instructions for emotion regulation were given (control, suppression, reappraisal, and mindfulness/acceptance; see Appendix A for script of emotion regulation instructions). Following the emotion induction, current distress and affect were measured. Participants were then asked to report current cravings to smoke and complete the Smoking Emotional Stroop task. Next, participants completed a manipulation check to assess adherence to the assigned emotion regulation condition. Finally, participants responded to debriefing questions to assess their beliefs about the purpose of the study, and were provided with additional debriefing information.

Lab Session Measures.

Smoking verification, current cravings, & distress. Pre-emotion-induction measures during the lab session day included self-reported time since last cigarette smoked (was required to be at least two hours) and current distress using the SUDS rating scale (described in Study 1).

Cravings. The 2-item intentions/desire to smoke subfactor of the 5-item version of the QSU-Brief (Toll, Katulakb, & McKee, 2006) was used to assess current cravings prior to the emotion induction. This measure has been shown to reliably produce two subfactors, intentions/desire to smoke and relief of negative affect/urgent desire to smoke. Relief of negative affect questions were not asked because they might prime the constructs being studied.

Emotion regulation and emotion induction. The emotion regulation instructions for the four different conditions (suppression, cognitive reappraisal, mindfulness, and a neutral control) were identical to the instructions and conditions described in more detail in Study 1 (also, see Appendix A for the complete text of the emotion regulation instructions for each condition). Similarly, the negative affect induction procedure was identical to that used in Study 1. Participants in all conditions watched the same brief video clip from *Return to Me* (Tugend & Hunt, 2000; described in more detail in the Pilot Study).

Distress and negative affect. Measures that followed the emotion induction included distress (SUDS ratings) and negative affect (PANAS); both of these measures are described in more detail above in Study 1.

Urges to smoke. Cravings after the emotion induction task were measured by the brief (10-item) form of the Questionnaire of Smoking Urges (QSU; Cox, Tiffany, & Christen, 2001). Participants responded to items such as *I have an urge for a cigarette*, reporting current urges to smoke on a scale from *strongly disagree* (0) to *strongly agree* (100). The brief QSU has shown good reliability and validity in previous studies.

Manipulation check. After watching the stimulus clip participants were asked to report freeform, what if any, emotions they experienced while watching the clip, and what if anything they did to manage the emotions. Participants were also asked to report the extent to which they were able to control their emotional responses on an 8-point scale from not at all (0) to completely (7).

Implicit measure of attentional bias/urge to smoke. Participants completed a modified smoking-related emotional Stroop task. Participants completed trials alternating between blocks of smoking-related words and blocks of matched neutral words, consistent with the procedure used by Waters et al. (2003); see also Gross, Jarvik, and Rosenblatt (1993). Accuracy and speed were recorded separately for smoking related words and for neutral words, and difference scores computed. Final brief measures of craving and affect were completed following the cognitive task to capture any changes over the task. This measure has been demonstrated to have good criterion validity (Sayette, 2004), better predicting distress than self-report, and predicting emotional bias/reactivity to smoking related cue words.

Appendix F

Original Hypotheses and Analytic Plan for Study 2

As previously noted, due to low retention in Study 2, the original analytic plan (detailed here) was no longer possible, and the revised analytic plan (reported above in the text of Study 2) was developed and implemented.

Primary Analyses

Hypothesis 1: Different types of emotion regulation will be differentially related to negative affect and distress. Emotion regulation condition (IV) is predicted to be associated with different levels of distress following exposure to the emotion induction stimulus. NA will be measured by 1) post- emotion-induction PANAS scores, and distress will be measured by pre- to post- emotion-induction changes in distress. Specifically, people in the cognitive restructuring (CR) and mindfulness acceptance (MA) conditions will report similar levels of distress and NA, and both CR and MA groups will report less distress and NA than the control group. Previous literature is mixed with regard to suppression and distress, with suppression more often associated with higher levels of distress and NA, but sometimes associated with minimal NA; thus no specific prediction is made regarding relative levels of distress and NA for the suppression (S) group. This hypothesis will be tested using a MANCOVA analysis, because I expect that distress and negative affect will be at least moderately correlated. Planned contrasts will be used to test the specific predictions for each condition.

Hypothesis 2: Different emotion regulation conditions will be differentially related to cravings to smoke. Emotion regulation condition (IV) is predicted to be

associated with craving to smoke following the emotion-induction. People in the suppression (S) group are expected to report higher cravings to smoke than those in any other condition. The control group is expected to have higher cravings to smoke than either the CR or the MA groups, which are expected to report similar levels of cravings. This hypothesis will be tested using ANOVA, with planned contrasts used to test the specific predictions for each condition.

Hypothesis 3: Different emotion regulation conditions will be differentially related to attentional bias to smoking cues. Emotion regulation condition (IV) is predicted to be associated with attentional bias to smoking cues following the emotion-induction. People in the suppression (S) group are expected to display greater distraction on the smoking-related (compared to the neutral) content of the smoking Stroop. The control group is expected to have higher cravings to smoke than either the CR or the MA groups, which are expected to report similar levels of cravings. This hypothesis will be tested using ANOVA, with planned contrasts used to test the specific predictions for each condition.

Moderation Analyses

Hypothesis 4. Post- emotion-induction distress will not be significantly independently related to smoking variables. Based on previous research, distress alone is not expected to predict urges to smoke or attentional bias to smoking cues. This hypothesis will be tested using Pearson correlations.

Hypothesis 5. Trait emotion regulation will moderate the relation between emotion regulation condition and distress and cravings to smoke and attentional

bias to smoking post- emotion-induction. Based on previous research, people higher in trait emotion suppression (as measured by the ERQ suppression subscale; Gross & John, 2003) and high in difficulty regulating negative emotion (as measured by high scores on the DERS [Gratz & Roemer, 2004] and low scores on the NMR [Catanzaro & Mearns, 1990]) are expected to report higher cravings and more distraction on the smoking Stroop. I predict an interaction between trait emotion regulation and emotion regulation condition in predicting distress and distraction on the smoking Stroop. This hypothesis will be tested using separate two-way ANOVAs (Condition: Suppression, Control, Mindfulness, Cognitive Reappraisal X trait emotion regulation measure [ERQ-S, DERS, NMR]: low and high) with planned contrasts for the outcomes urges to smoke and smoking Stroop scores, and a similar two-way MANOVA for the outcomes of distress and negative affect.

Hypothesis 6. Smoking expectancies for mood regulation will moderate the relation between distress and cravings to smoke and attentional bias to smoking post- emotion-induction. Previous research has shown that people who expect smoking to reduce negative emotions are more likely to have cravings and to smoke in NA situations, and are more likely to relapse to smoking when quitting. People with higher levels of negative affect reduction expectancies (as measured by the negative affect subscale of the SCQ; Brandon & Baker, 1991) for smoking are expected to experience more self-reported cravings and more attentional bias to smoking cues (as measured by distraction on the smoking-related [relative to neutral] content on the smoking Stroop task). This hypothesis will be tested by regression moderation analyses.