AN EXPERIMENTAL EXAMINATION OF MINDFULNESS AS A STRATEGY FOR COPING WITH CRAVINGS FOR ALCOHOL

By

CARA MARIE MURPHY

(Under the Direction of James MacKillop)

ABSTRACT

Objective: To experimentally test a mindfulness coping strategy to reduce craving and urge distress when experiencing cue-elicited cravings for alcohol. *Method:* After being exposed to neutral cues and alcohol cues, eighty-four heavy drinkers were asked to observe and accept their cravings, to try to distract themselves from their cravings, or to use whatever strategy they liked during a series of exposures to alcohol cues with subsequent extinction intervals in a simulated bar environment. *Results:* Mixed ANOVAs of craving and urge distress revealed that groups endorsed differential reactivity and extinction to alcohol cues as a function of their coping strategies. The group instructed to distract themselves reported the largest decreases in craving and urge distress. *Conclusions:* In this sample, occupying one's mind with another activity was more effective at reducing craving and distress from craving acutely than a mindfulness "urge surfing" approach. In the short term, engaging in a pleasurable distracting activity may be more helpful at reducing craving for alcohol.

INDEX WORDS: Alcohol, Craving, Mindfulness, Distraction, Coping

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TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

Alcohol use disorders are a major public health concern with many negative consequences and costs associated with drinking including unintended injuries, assaults, and deaths (Hingson et al., 2005). Additionally, excessive alcohol consumption results in significant healthcare costs as it is related to many life-threatening diseases such as liver disease, cancer, diabetes, and neuropsychiatric disorders (Rehm, et al., 2009). Recent estimates suggest that during their lifetime, 30% of adults in the United States will meet criteria for an Alcohol Use Disorder (AUD), often associated with significant disability (Hasin et al., 2007). Therefore, alcohol use disorders remain a serious concern on both the individual and the public health levels.

Cue-elicited Craving

For many individuals struggling with alcohol use disorders, craving, a strong or persistent desire to drink, is a common phenomenon. Many individuals who are diagnosed with alcohol dependence experience urges to drink and cravings are considered to be one feature that maintains problematic drinking (Bohn, Krahn, & Staehler, 1995; Flannery, Volpicelli, & Pettinati, 1999). In fact, many former users begin using and abusing alcohol again after treatment (Breslin, Zack, & McMain, 2002; Ramo & Brown, 2008). Urges to drink, substance cues, and withdrawal are typical relapse precipitants (Zywiak, Connors, Maisto, & Westerberg, 1996). When considering cue-elicited craving, research has shown that giving in to urges and temptations in the presence of cues was a relapse precursor in 55% of adults and 37% of

adolescents (Ramo & Brown, 2008). As such, many interventions have been designed to help individuals minimize their desire to drink in response to alcohol cues.

Clinical Approaches for Addressing Cue-elicited Craving: Cue Exposure Treatment

Given the evidence implicating the importance of craving in addictive behavior, some treatments for alcohol use disorders directly target cue-elicited craving as a risk factor. These treatments traditionally involve exposure to relevant cues with response-prevention in the presence of a therapist. These techniques are aimed at learning new and more adaptive behavioral responses when presented with cues that may signal use. Specifically, cue exposure treatment (CET) for alcohol dependence aims to decrease motivation for alcohol use by exposing a person to alcohol or other relevant cues and preventing alcohol consumption. This pairing is used to extinguish conditioned craving in response to alcohol cues (Childress, McLellan, & O'Brien, 1986). Based on classical conditioning, extinction, or a reduction in the typical psychological and behavioral responses, will occur when someone is repeatedly exposed to an alcohol cue while preventing the drinking response (Monti, Kadden, Rohsenow, Cooney, & Abrams, 2002). CET applies exposure with response prevention in much the same way as exposure treatment typically is used in the treatment of other psychological disorders such as anxiety disorders (Foa & Kozak, 1986; Franklin, Abramowitz, Kozak, Levitt, & Foa, 2000). CET for alcohol use disorders is used both in a pure extinction model (e.g., Drummond and Glautier, 1994) and in an extinction with concurrent coping-skills training model (Monti & Rohsenow, 1999). In the former, CET consists of pure exposure with response prevention to weaken the association between alcohol and craving whereas in the latter, participants are also taught coping skills to help minimize cravings during the exposure.

Studies using CET have found that it may be effective in increasing the amount of time an individual remains sober before relapsing to drinking heavily and reducing total alcohol consumption (Drummond & Glautier, 1994), reducing the quantity and frequency of heavy drinking (Sitharthan, Sitharthan, Hough, & Kavanagh, 1997), and reducing the desire to drink and increasing abstinence (Monti et al., 1993). However, a meta-analysis looking at CET in alcohol, nicotine, cocaine, and opiates found that evidence has not consistently supported the efficacy of CET (Conklin & Tiffany, 2002). When examined closely, however, this meta-analysis shows differential results of treatment effects by drug, with studies on alcohol proving to have more favorable outcomes (MacKillop & Monti, 2007).

Mindfulness as a Clinical Approach for Addressing Craving

Another technique thought to help individuals endure internal experiential states, such as craving, is mindfulness. Mindfulness is a way of focusing attention to the present that originated as part of Buddhist meditation techniques (Kumar, 2002). It can be described as a "non-judgmental observation of the ongoing stream of internal and external stimuli as they arise" (Baer, 2003, p. 125). Using mindfulness, individuals learn to focus attention, moment to moment, on the present world and sensations that they are experiencing. In a mindfulness framework, paying attention is to occur in a particular way: "on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994, p. 4). The thoughts and emotions an individual experiences are observed as mere events in a stream of conscious existence. This allows someone in a mindful state to observe thoughts and feelings and to react to them as a dispassionate observer (Bishop et al., 2004). Inherent in a refocusing of attention to the observance of the self, a "space" is created between an individual's perception of a phenomena and the subsequent response to it, allowing for a reaction in a non-automatic, habitual way

(Bishop et al., 2004). Taken together, two key components of mindfulness include regulating one's attention (i.e., awareness of sensations, thoughts, and feelings) and adopting a particular orientation (i.e., openness and acceptance of experiencing events fully) towards one's experiences (Keng, Smoski, & Robins, 2011; Bishop, 2004). As part of this acceptance, an individual seeks to abandon former preconceptions and schemas and to allow any feelings, sensations, and thoughts to occur without elaborating, labeling, or judging them.

In recent years, mindfulness-based interventions have become increasingly more common in psychological treatment. Many treatments including, but not limited to, Mindfulness-Based Stress Reduction (MBSR), Dialectical Behavior Therapy (DBT), Acceptance and Commitment Therapy (ACT), and Mindfulness-Based Relapse Prevention (MBRP) include mindfulness as a key element (for reviews, see Bishop et al., 2004; Keng et al., 2011; Zgierska et al., 2009). Of note, although many present-day Western mindfulness interventions emerged from Buddhist traditions, there is great variability between them in the teaching and practice of mindfulness that ranges from formal mindfulness meditative practices (e.g., Vipassana and Zen meditations, MBSR and other standardized meditations) to more informal mindfulness skills and exercises in treatments such as ACT and DBT (Chiesa & Malinowski, 2011; Keng et al., 2011).

While differences exist between the ways mindfulness has been incorporated into an array of psychological interventions, in general, the underlying goal involves helping individuals experience their suffering in a new and less distressing way. When considering addictive behavior from a Buddhist perspective, it may be seen as "a false refuge…which unwittingly, but inevitably, leads to suffering" (Groves & Farmer, 1994, p. 191). Individuals can be taught to use mindfulness skills and/or meditation in order to perceive craving, a cognitive representation of a desire to use, in a less distressing way and to respond to it in a less automatic manner

(Witkiewitz, Marlatt, & Walker, 2005). This idea of withstanding urges without indulging has given rise to the phrase "urge surfing" in which an urge is akin to a wave in the ocean; as the urge increases, clients are encouraged to "surf the urge by allowing it to pass without being wiped out by giving into it" (Marlatt, 2002, p. 47).

Individuals experiencing cravings to use a drug are taught to develop new and more accepting attitudes towards their urges (Marlatt, 2002). This includes employing a de-centered perspective of craving, in which an urge becomes a mental event instead of an attribute of the self (e.g., de- centering "I want to drink" may transform it to "I'm noticing that I'm having an urge to drink currently"). Monitoring one's experiences in an unattached way can facilitate an interpretation of reality that is less biased by previous experiences and conditioning (Grovers & Farmer, 1994) allowing processing that is more controlled and detached rather than automatic (Breslin, 2002). Controlled processing may facilitate acceptance and decrease reactive behavior thereby providing the individual the capacity to choose to do something other than drink. Breaking this cycle putatively weakens the association between craving and automatic use.

Preliminary research has been conducted in order to investigate the relationship between alcohol misuse, mindfulness, treatment, and recovery. Largely, this has taken the form of correlational studies and clinical intervention research. Correlational research has confirmed that higher levels of two key elements of mindfulness, awareness of the present moment and nonjudgment of the thoughts and feelings, are associated with lower levels of adverse alcohol-related consequences such as guilt after drinking, blackouts, driving while intoxicated, and alcohol-related injuries (Murphy & MacKillop, 2012; Fernandez, Wood, Stein, & Rossi, 2010). Similarly, individuals higher in mindfulness are better able to disengage attention from alcohol

cues, resulting in larger decrease in heart rate from alcohol cue exposure to a recovery period (Garland, 2011).

With regard to clinical intervention research, a number of studies have attempted to investigate the purported ability of mindfulness-based interventions to be effective both as standalone interventions and as adjuncts to treatment. To this end, a number of case studies and pilot studies, many of which are limited by methodological factors like small sample sizes and non-randomization of participants, have been conducted. In one of the first studies using meditative practices to reduce drinking in college students, meditation did not reduce drinking more substantially than either aerobic exercise or a no treatment control condition (Murphy, Pagano, & Marlatt, 1986). Another intervention that included mindful meditation, specifically MBSR, as an active component in a multifaceted treatment for adolescents who had recently completed substance abuse treatment, was similarly unsuccessful with no decreases in substance use during treatment reported (Bootzin & Stevens, 2005). Equally, in a pilot study of participants with alcohol and/or cocaine use disorders who received mindfulness training or cognitive behavioral therapy (CBT), a trended was found involving lower levels of alcohol use during treatment in the CBT group (Brewer et al., 2009). Finally, using a treatment specifically focused on addictive behavior, MBRP, those who had finished treatment reported decreases in some noteworthy variables, such as in depression and stress, but other variables did not change significantly including cravings for alcohol and percentage of days abstinent (Zgierska et al., 2008).

Other studies have been supportive of mindfulness-based treatment including one study, comparing inmates who enrolled in a 10-day course in Vipassana, a mindfulness meditation practice, to those receiving treatment as usual (TAU), with promising reductions in frequency

and quantity of drinking and drug use for individuals who had practiced mindful meditation (Bowen et al., 2006). Secondary analyses of these data revealed that individuals who practiced mindful meditation reported significant decreases in avoidance of thoughts when compared to individuals who did not (Bowen, Witkiewitz, Dillworth, & Marlatt, 2007). Likewise, in an open-treatment pilot trial using mindfulness and modification therapy (MMT), women with AUDs who were arrested for domestic violence showed decreases in number of drinking days and number of drinks consumed per drinking day (Wupperman et al., 2012).

In addition to the aforementioned studies, a limited number of randomized controlled treatment trials (RCTs) have investigated the effects of various mindfulness-based treatments on alcohol-related outcomes with mixed findings. In a study of individuals with alcohol and/or drug problems and a diagnosis of Borderline Personality Disorder (BPD) that compared DBT to TAU, results indicated that those in the mindfulness-oriented program had a higher proportion of days abstinent from alcohol and/or drugs (Linehan et al., 1999). Using MBSR meditation as an adjunct to treatment, Alterman, Koppenhaver, Mulholland, Ladden, and Baime (2004) concluded that there was little evidence that mindfulness meditation enhanced treatment of those in a recovery house who were substance and/or alcohol dependent. In a third study, Bowen et al. (2009) compared group MBRP to TAU in those with SUDs who had completed inpatient or outpatient treatment. Those in the MBRP condition showed significantly lower rates of substance use and also reported decreases in craving and increases in acceptance and acting with awareness. Despite these initial gains, the groups reported similar levels of substance use at 4-month follow up. Another mindfulness intervention, mindfulness-oriented recovery enhancement (MORE), involves relating mindfulness principles to craving, relapse triggers, and other alcohol-related variables and practicing mindful breathing and meditation. In one study using this

intervention, participants in the MORE group were compared to individuals in an evidence-based support group for alcohol dependence (Garland, Gaylord, Boettiger, & Howard, 2010). While the MORE group reported significantly lower levels of thought suppression and physiological data indicated greater capability to deal with alcohol cues, there were not significant decreases in self-reported craving post-treatment. The authors speculated this could be the result of an increased awareness of cravings with a decreased tendency to suppress them.

While a mindfulness-based approach may have promise in the treatment of addictive disorders, the findings have been mixed and additional research to validate preliminary findings in this area is needed (Black, 2012). To date, no studies have examined the acute effects of mindfulness-based coping skills on cue-elicited craving for alcohol under controlled laboratory conditions. As a result, there is no direct evidence that mindfulness is efficacious in reducing urges to drink. Laboratory research is critical for determining the effects of a mindfulness intervention under controlled conditions including the ways in which a mindfulness strategy may exert its effects. Several relevant functional variables are of interest such as desire to drink, mood/emotional state, and distress from urges. Numerous studies have shown a strong link between negative affect and substance use with negative affect being an unequivocal predictor of relapse (Hodgins, el Guebaly, & Armstrong, 1995; Baker, 2004). Studies have also demonstrated that negative mood generally accompanies acute cue-elicited alcohol craving (Rohsenow, Monti, Abrams, Rubonis, 1992; MacKillop, 2006). Because mindfulness trainings teach individuals to process information in a novel way (i.e., noticing reactionary thoughts, feelings, and sensations and accepting them nonjudgmentally), the practices of mindfulness may result in a change in how sensations, thoughts, and feelings are experienced (Witkiewitz, Marlatt, & Walker, 2005; Bishop et al., 2004). In particular, emotional distress may be experienced as less unpleasant since

acceptance may change the subjective meaning (Bishop et al., 2004). Therefore, it may be the case that the detached/less automatic processing of mindfulness directly reduces craving. Equally possible, is that acceptance of craving makes urges more tolerable, and therefore, less distressing.

Proposed Study

In light of the findings to date, the goal of the current study was to conduct an experimental test of the effects of mindfulness on cue-elicited craving for alcohol. In the proposed study, cue-elicited urges were evoked for the purpose of assessing the effectiveness of a mindfulness strategy (MND) on reactivity to alcohol cues including craving and distress from craving. It was predicted that acute exposure to alcohol cues would significantly increase urge to drink (Carter & Tiffany, 1999) and that this urge would dissipate over time (MacKillop & Lisman, 2008; Staiger & White, 1991). Therefore, the objective of the present study was to better understand if individuals given a MND strategy would have greater reductions in urge for alcohol, be less distressed by their urges, and be less reactive to subsequent exposures to alcohol cues than individuals in control groups. Specifically, participants in the MND group, who were instructed to notice their urges and to accept them, were compared to individuals active and passive control groups. The active control group received a distraction strategy (DST), a credible alternative recommendation that is routinely advised in self-help treatment materials (e.g., NIAAA, 2010). The passive control group (CTL) similarly underwent cue-exposures but did not receive any particular strategy to use to cope with cravings.

This study had two primary hypotheses. The first was that craving would be lower for participants using a MND strategy when compared to individuals in the DST and CTL groups.

The second primary hypothesis was that participants in the MND group would become less distressed by their cravings than individuals in the DST and CTL groups.

In summary, the following hypotheses were tested:

1. Compared to those in the CTL and DST groups, those in the MND condition would experience decreased craving following exposure to alcohol cues, both acutely and during an extended extinction period.
2. Compared to those in the MND condition, the CTL and DST groups would report significantly higher levels of distress from urges to drink, both acutely and during an extended extinction period.

In addition to primary hypotheses regarding craving and urge distress, positive and negative affect and psychophysiological arousal were also examined but without specific hypotheses.

CHAPTER 2

METHOD

Participants

In order to determine an appropriate sample size, an *a priori* power analysis was conducted using G*Power (Erdfelder, Faul, & Buchner, 1996). Power was calculated for a series of mixed ANOVAs (group as a three-level between-subjects variable and time point as a within-subjects variable) with omnibus group comparisons subsequently decomposed to determine specific group differences. The manipulations were anticipated to be highly salient to participants, reflecting substantial instructional differences, and were estimated to have an effect size of $f = 0.35$; with $\alpha = 0.05$ and $\beta = 0.8$, this suggested the lowerbound sample size would be N=81 (n = 27), reflecting a critical $F(2, 78) = 3.11$.

Participants ($N = 84$) were recruited from university and community populations via advertisements soliciting drinkers for a research study. Enrollment criteria included being 21-29 years of age and heavy or "at risk" drinkers defined by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) as consuming more than fourteen standard drinks/week for men and more than seven for women (NIAAA, 2010). Additionally, participants had to demonstrate hazardous alcohol use, defined as scoring ≥7 on the Alcohol Use Disorders Identification Test (AUDIT). This cutoff is based on previous research of college students meeting DSM-IV criteria of alcohol abuse or dependence (Aertgeerts et al., 2000). Finally, individuals were required to

attend the session without a positive breath alcohol level (BrAC). Participants received $30 for participation. Sample characteristics are presented in Table 1.

Measures

Demographics Assessment. This contains standard demographic information including race, ethnicity, age, gender, and other demographic variables.

Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985). This 7-item measure assesses weekly alcohol use and heavy drinking episodes. Participants indicate their typical pattern of use on each day over the past month by completing seven boxes that pertain to mean consumption on a given day of the week.

Alcohol Use Disorders Identification Test (AUDIT; Babor, de la Fuente, Saunders, & Grant, WHO, 1992). The AUDIT is a 10-item screening tool to identify those who have an Alcohol Use Disorder. It measures levels of alcohol consumption that are potentially hazardous and/or harmful to a person's health. Three items focus on the amount and frequency of drinking; three items ask about alcohol dependence; four items focus on problems caused by alcohol. Each response is given 0 to 4 points with higher overall scores indicating harmful and hazardous use.

Penn Alcohol Craving Scale (PACS; Flannery, Volpicelli, & Pettinati, 1999). The PACS is a 5-item self-report questionnaire assessing cravings for alcohol. The first four items assess frequency, intensity, and duration of cravings for alcohol and perceived ability to resist drinking. The final item asks responders to report their average craving over a given period of time. Each response is given 0 to 6 points with higher overall scores indicating that an individual experiences a greater level alcohol craving.

Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al. 2006). The FFMQ is a 39-question scale that was derived from five independent mindfulness questionnaires measuring trait mindfulness. The questionnaire consists of five scales each containing either 7 or 8 items. Each scales corresponds to a facet of mindfulness including non-reactivity to inner experience, observing, acting with awareness, describing, and nonjudging of experience. Items are rated on a 5-point Likert-type scale from 1 *(never or very rarely true)* to 5 *(very often or always true)* with higher scale scores indicating higher levels of trait mindfulness.

Drinking Refusal Self-efficacy Questionnaire-Revised Adolescent (DRSEQ-RA; Young, Hasking, Oei, & Loveday, 2007). The DRSEQ-RA is a 19-item questionnaire measuring adolescents' perceived ability that they will be capable of resisting alcohol in a variety of different situations such as under social pressure, for emotional relief, and when presented with the opportunity to drink. Items are rated in terms of certainty from 1 *(I am very sure I would drink)* to 6 *(I am very sure I would NOT drink),* with higher scores indicating greater perceived self-efficacy.

Alcohol Craving. Self-reported craving for alcohol was measured using a 4-item questionnaire based on previous research on alcohol urge (Stasiewicz et al., 2007; Klein et al., 2007). Participants were asked to answer, currently, "How much do you want a drink?", "How much do you crave a drink?", "How much do you desire a drink?" and "How high is your urge for a drink?" Questions were scored on an 11-point Likert-type scale ranging from 0 *(min)* to 10 *(max).*

*Urge Distress. S*elf-reported distress from craving for alcohol was assessed using a 3-item questionnaire. Participants were asked, currently, "How annoying is not being able to drink?", "How much is your desire to drink bothering you?", and "How uncomfortable is your

craving to drink?" Questions were scored on an 11-point Likert-type scale ranging from 0 *(min)* to 10 *(max).*

Self-reported Mood. Affect was measured based on the circumplex model of affect with one dimension ranging from unpleasant to pleasant and the other from activation to deactivation (Posner, Russell, & Peterson, 2005). Mood was assessed using an 8-item questionnaire with half of the items corresponding to positive affect (PA; happy, calm, excited, and relaxed) and half corresponding to negative affect (NA: bored, sad, stressed, and tense). Participants indicated the extent to which they felt each emotion "right now" on a scale of 0 (*very slightly/not at all*) to 10 (*extremely*). Cumulative scores were totaled for the pleasant (PA) and unpleasant (NA) subscales.

Breath Alcohol Concentration (BrAc). BrAc was measured using a commercially available breathalyzer system (The Alco-Sensor® IV, Intoximeters Inc.). This fuel cell based instrument samples deep lung breath and displays a precise three digit BrAc readout.

Psychophysiological Arousal. Psychophysiological arousal was assessed using a self-inflating wrist cuff (LifeSource© blood pressure monitor model UB-512) measuring mean arterial pressure (MAP) and heart rate beats per minute (HR).

Manipulation Checks. Two separate manipulation checks were used. The first consisted of two questions asked following each exposure and extinction period. These questions asked the extent to which participants were distracting themselves from their cravings and the extent to which they were observing and accepting their cravings using an 11-point Likert-type scale. The second manipulation check consisted was a brief survey completed as part of the exit assessment. It assessed the extent to which participants understood and followed the instructions they were given over the course of the session. This consisted of true/false questions to check for

understanding (e.g., “The recording I listened to asked me to accept my thoughts without judging them”) and Likert-scale type questions that measured adherence to the instructional set (e.g., “I intentionally tried to distract myself from wanting to drink and was able to”) measured from 1 *(strongly disagree)* to 5 *(strongly agree)*.

Debriefing Survey. Participants were asked to provide qualitative information on the study such as what they thought the purpose was, if there were any extenuating circumstances that affected their behavior, and whether or not they would recommend participating in the study.

Procedures

All procedures were approved by the UGA Institutional Review Board. Individuals who responded to advertisements participated in a preliminary screening via telephone to assess for inclusion criteria. Those who meet criteria came to the laboratory for an in-person session lasting approximately 2.5 hours. Figure 1 shows a schematic of relevant study time intervals. After sobriety was confirmed via breathalyzer, participants underwent written informed consent that explained that the purpose of the study was to examine techniques used to cope with alcohol cravings. Then, participants completed a baseline assessment of several questionnaires (e.g., demographic information, alcohol involvement, personality measures). After completing initial baseline assessments, individuals underwent the first of four cue exposures that made use of auditory, visual, olfactory, and tactile cues in a neutral laboratory room. During the initial exposure, neutral beverage cues (i.e., water) were used. Participants listened to an audio recording that asked them to do several things (e.g., pick up the glass and inhale the smell of the drink). Immediately following the neutral cue exposure, participants completed a brief assessment measuring their self-reported craving for alcohol, how distressing any alcohol urges were to them, their overall mood, and their heart rate.

Participants were then escorted to a simulated bar environment consisting of a stocked bar, drinking paraphernalia, and alcohol-related decorations. Atop the bar when participants entered, was an individual's preferred alcoholic beverage, which was identified during the telephone screen. After getting acclimated, participants again listened to the audio recording that involved auditory, visual, olfactory, and tactile cues, this time using the alcoholic beverage, but otherwise matched to the neutral cue exposure. Afterward, they completed a brief assessment of craving, urge distress, mood, and heart rate. Then, based on sequential randomization by gender, participants were assigned to one of three conditions (described below), each given unique instructions regarding how to address any cravings they experienced.

Mindfulness Condition. The recording for those in the MND group instructed participants to pay close attention to thoughts, urges, and feelings without trying to get rid of them adapted from a mindfulness-based smoking intervention (Bowen & Marlatt, 2009) and core mindfulness skills training (Linehan, 1993). They were instructed to try to view their experiences with openness and acceptance and to observe the ways in which what they were experiencing was affecting them. Participants were asked to relax and to notice as thoughts and feelings came and went. They were reminded that a thought is just a thought and a feeling is just a feeling and they were told that they did not have to let these experiences control them.

Distraction Condition. The recording in the DST group instructed participants that distracting themselves could help eliminate unwanted cravings. They were told that it may be helpful to take their minds off drinking by doing something else or thinking about something else and that their goal was to occupy their minds enough that they would be distracted from their urges to drink. Participants were instructed to avoid focusing on drinking-related stimuli and on their responses to them. They were reminded that the mind and body can think and feel anything

they want. In order to take their minds off of these thoughts, feelings, and sensations, they were encouraged to try to focus their attention and interest on something else.

Control Condition. The recording in the CTL condition informed participants that they would not be given any specific recommendation on how to handle their cravings. Since they were not assigned a particular strategy, they were instructed that they were free to use whatever strategy they wanted to deal with any cravings they experienced over the course of the session. They were encouraged to use techniques that they had used in the past and/or to try to do whatever they thought would be most helpful for them.

Experimenters who worked with participants were blinded to condition. Participants underwent three separate exposures to alcohol cues with a fresh beverage poured by the experimenter on each occasion. After each exposure, the participant remained alone in the bar for a four-minute extinction period. Participants were instructed that they should use whatever strategy had been described to them in the recording during this time. When time had elapsed, the participant was asked to complete a brief questionnaire and to provide physiological data (i.e., heart rate). To minimize experimenter intrusion, heart rate was only measured during the first and third cue exposure and extinction periods. Each exposure-extinction interval lasted approximately 15 minutes for a total of ~45 minutes in the simulated bar environment.

Once the extinction period was complete, participants were escorted back to a neutral laboratory room where they filled out a brief exit assessment and were debriefed. As part of the debriefing, participants were provided with a copy of *Rethinking Drinking: Alcohol and Your Health* (NIAAA, 2010) and were given psychoeducation about how environmental cues can serve as triggers that increase an individual's desire to drink. The exposure-extinction portion of the study was described as a type of self-control training illustrating that an individual can

endure an urge to drink without drinking. Participants were informed that they may wish to try the strategy from the session outside of the laboratory if they experienced any unwanted cravings for alcohol in the future. In the MND and DST groups, the given strategies were reiterated (i.e., urge surfing via noticing, accepting, and riding out a craving for the MND group and, for the DST group, distracting themselves from a craving with another activity). Individuals in the CTL group were informed that, even though they were not given any particular strategy initially, they may have noticed that their cravings decreased over the course of the session. They were informed that urges usually decrease in time and were encouraged to remind themselves of this in the future if they experienced unwanted urges for alcohol.

One week following the study, participants were contacted by telephone and asked to answer a few questions about their drinking during the interlude. Follow-up items included assessing drinks/day (DDQ) and craving (PACS). Additionally, participants were asked questions regarding whether or not they had noticed any changes in their drinking since participating (e.g., "Did you try to cut back on your drinking at all in the past week?", "Do you feel like participating in this study affected your drinking at all in the past week?").

Data Analysis Plan

Preliminary Analyses. Initial tests for outliers and normality distributions were conducted to ensure that all values were within the acceptable range. One-way tests of analysis of variance (ANOVAs) were conducted to compare group adherence to and understanding of instructions based on the questions administered during the manipulation check questionnaire. The self-report dependent variables (craving, urge distress, and affect) were examined to determine internal consistency using Cronbach's α and reliability without an item. Items found to diminish overall consistency were excluded from analyses.

Additionally, trait mindfulness, drinks per week, and drink refusal self-efficacy were compared using one-way ANOVAs at baseline to ensure that no significant differences existed on these measures that could confound potential effects of the strategies. Mixed ANOVAs were used to compare the groups on initial reactivity to alcohol cues to ensure that all groups were equally responsive to cues with regard to craving, urge distress, HR, PA, and NA.

Primary Analyses. The primary analyses applied 3 (condition) × 6 (time) mixed ANOVAs measuring responses following three periods of exposure to alcohol cues and three extinction periods on the two primary dependent variables: craving and urge distress. A mixed approach appropriately accounted for differences at previous time points, increasing power by factoring between-subject differences out of the error term. In the ANOVAs, group (MND, DST, CTL) served as a three-level between-subjects independent variable and time served as a six-level within-subjects independent variable. Where main effects of group were present, in the absence of significant time × group interactions, the main effect of group was compared across time using dependent samples t-tests of marginal means. Where significant time × group interactions were present, follow-up analyses decomposed the interactions via 3 × 2 mixed-ANOVAs for adjacent time points. Again, when significant local interactions were present, dependent-samples t-tests, measuring simple effects of time within each group at adjacent time points, were conducted.

Secondary Analyses. Secondary analyses measured differences in PA, NA, and HR. Initially, like in the primary analyses, 3 (condition) × 6 (time) mixed ANOVAs were conducted. Mixed ANOVAs without significant interactions were followed by dependent samples t-tests of marginal means. Where significant time × group interactions were present, follow-up analyses decomposed the interactions into 3 × 2 mixed-ANOVAs of adjacent time points. If these tests,

too, revealed significant local interactions, dependent-samples t-tests, measuring simple effects of time within each group at adjacent time points, were conducted.

CHAPTER 3

RESULTS

Preliminary Analyses

Initial analyses were conducted to examine possible baseline difference between groups. Additionally, the data were examined for outliers, defined as more than three standard deviations from the mean. One such value was identified in total drinks/week and was recoded as one unit higher than the greatest non-outlier value based on the recommendations of Tabachnick and Fidell (2006). Table 1 shows the baseline characteristics of the sample. A series of one-way ANOVAs were conducted that showed no significant differences between groups on age, education, drinks/week, drink refusal self-efficacy, or trait-level mindfulness.

The self-report dependent variables (craving, urge, PA, and NA) were examined to determine internal consistency using Cronbach's α during the brief repeated assessments. The four question craving composite demonstrated excellent internal reliability at all seven time points (αs= .98–.99). Similarly, the three question urge distress composite demonstrated excellent internal consistency (αs = .93–.96). When evaluating internal consistency of the PA items, at all seven time points, internal consistency was improved by excluding the item "excited" (resulting αs =.63-.79) from the pleasant mood scale, as was the case with removing "bored" from the unpleasant mood scale (resulting αs =.75-.83).

A series of one-way ANOVAs were conducted to detect strategy adherence to instructional set during exposure and extinction periods (Table 3). At all time points, the MND

and DST groups endorsed adhering to their given strategies (Table 3). In addition, exit assessment analyses confirmed that groups demonstrated adequate understanding of and adherence to the prescribed strategies (Table 4). When asked to evaluate various statements regarding study procedures as true or false and to provide their level of agreement/disagreement to a variety of statements, the groups responded in anticipated ways. The MND group reported that they had been asked to accept their thoughts, to allow craving to be present, and to try not to evaluate or judge their thoughts at significantly higher levels. Likewise, the DST group reported significantly higher levels of being asked to distract themselves, to take their minds off of drinking, and to try to make their urges go away. As all groups responded as anticipated in accordance with group instructional sets, no participants were excluded from the analyses.

Mixed ANOVAs comparing the three groups on initial reactivity to alcohol cues on the two primary dependent variables (craving and urge distress) and the three secondary dependent variables (PA, NA, and HR) did not reveal significant group × time interactions (Table 5). Therefore, all three groups were similarly reactive on dependent variables before randomization to group.

Primary Analyses

Figure 2 displays the primary motivational variables, craving and urge distress, over the seven repeated time points. Mixed ANOVAs for self-reported craving, distress from craving, and secondary motivational measures are shown in Table 6. As anticipated, there were significant group × time interactions for craving and urge distress, indicating differential responding. Therefore, in order to appropriately account for individuals' responses at the previous time point, five follow-up mixed ANOVAs of adjacent time points subsequently were conducted (Table 7) and simple effects were calculated for interactions (Table 8).

With regard to craving, following the first extinction period, there was a significant condition × time interaction. Paired samples t-tests (Table 8) revealed individuals in the MND group did not significantly decrease in craving like the DST and CTL groups did. Similarly, there was a significant interaction of group and time when the groups were presented with alcohol cues for a second time. Here, the DST group did not report a significant increase in craving, whereas the other two groups did. For the remaining cue exposure and extinction periods, significant interactions were not present. Analyzing main effects of time on craving revealed that all three groups similarly decreased during the second extinction period, increased during the third alcohol cue exposure, and then decreased again during the final extinction period.

With regard to urge distress, following the initial extinction period, there was a significant condition × time interaction (Table 7). Follow-up analyses (Table 8) revealed all groups being significantly less bothered by their cravings for alcohol, but the decrease in urge distress was more precipitous in the DST group. When the groups were presented with alcohol cues for a second time, there was a trend toward another time by condition interaction. Follow-up tests indicated that the MND group and the DST group became less reactive and did not report the significant increase in urge distress seen in the CTL group. For the remaining cue exposure and extinction periods, significant interactions were not present. Analyzing main effects of time on urge distress revealed that all three groups similarly decreased during the second extinction period, increased during the third alcohol cue exposure, and then decreased again during the final extinction period.

Secondary Analyses

Table 6 shows the 3 × 6 mixed ANOVAs for PA, NA, and HR. It should be noted that initial exposure to alcohol cues did not significantly change participants' levels of PA or NA (Table 5). Nevertheless, comparing dependent variables as the exposure-extinction continued revealed a significant interaction of condition and time for both PA and NA. All changes in mood experienced over the duration of the session were relatively modest. With regard to HR there was a significant increase following the initial exposure to alcohol cues (Table 5). Following randomization into strategy group, however, no interaction was present (Table 6). Figure 3 displays changes in the secondary variables over time.

With regard to NA, over the course of the exposure-extinction period, on average, the unpleasant emotions experienced by the DST group decreased by approximately 4 points while the MND and CTL groups decreased by less than 1 point (Figure 3). While this reduction was gradual, follow-up tests revealed one significant interaction of adjacent time points. This occurred following the first extinction period, $F(2,81) = 3.83$, $p = .03$, $\eta^2 = .09$. When comparing NA of the DST group after the first alcohol cue exposure (M=12.32, SD=1.42) to NA after the first extinction period (M=10.50, SD=1.08), there was a significant decrease, $t(27)=3.00$, $p=.01$. This was not true of the MND and CTL groups whose NA remained primarily static (Figure 3). There were no other significant interactions of time and condition nor were main effects of time present.

With regard to PA, over the course of the exposure-extinction period, on average, the pleasant emotions experienced by the DST group increased by more than 3 points while the MND group increased by approximately 1 point and the CTL decreased approximately 1 point (Figure 3). While this resulted in a significant interaction when comparing PA from start to finish

of the exposure-extinction period (Table 6), comparing adjacent time points revealed very subtle differences from one epoch to the next. PA changed gradually and slightly (η^2s ≤ .04). All three groups had similar increases and decreases in PA resulting in several significant main effects. In all groups, PA increased following the initial extinction period, $F(2,81) = 9.49$, $p < .01$, $\eta^2 = .11$, decreased following the subsequent exposure to alcohol cues, $F(2,81) = 6.21$, $p = .02$, $\eta^2 = .07$, and then increased again during the second extinction period, $F(2,81) = 4.76$, $p = .03$, $\eta^2 = .06$. No main effects were detected during the final alcohol cue exposure or extinction periods. Although an interaction existed when analyzing the exposure-extinction period as a whole, the size of the differences between groups at any two contiguous periods was miniscule. As a result, no significant interactions were detected between adjacent time points.

With regard to HR, there was no significant time × group interaction although there was a significant effect of time (Figure 3). Across groups, participants experienced significantly higher HRs following the initial exposure to alcohol cues ($M = 75.\ 61$, $SE = 1.40$) when compared to their HRs following the exposure to neutral cues ($M = 72.24$, $SE = 1.32$), $t\ (83) = -6.43$, $p < .01$. Similarly, across groups, participants had significantly lower HRs following the first extinction period ($M = 73.40$, $SE = 1.37$) when compared to the first alcohol cue exposure ($M = 75.\ 61$, $SE = 1.40$), $t\ (83) = -3.34$, $p < .01$). There was not a significant effect of the third alcohol cue exposure, $t\ (83) = 1.85$, $p = .07$, or the third extinction period $t\ (83) = -1.46$, $p = .15$.

Exit Assessment

Following the exposure-extinction period, when comparing individuals randomized to receive DST and MND coping strategies, there were no significant differences reported on perceived difficulty, $t(54) = -1.81$, $p > .05$. Nonetheless, compared to participants in the other groups, those in the DST group were significantly more likely to indicate that they thought the

strategy was useful, $F(2,81) = 3.30$, $p < .05$. Correspondingly, the DST group indicated that they thought the strategy would be significantly more helpful in dealing with cravings for alcohol than the other groups, $F(2,81) = 7.91$, $p < .01$. Following the exposure-extinction period, participants were asked to rate, again, their perceived abilities to refuse or resist alcoholic beverages (i.e., self-efficacy). Compared to their responses before the initial cue exposure, across groups, individuals reported greater self-efficacy in their abilities to refuse and/or resist drinking, $F(2, 81) = 4.63$, $p = .03$. There were no significant group × time interactions.

Follow-up Analyses

Approximately 81% of the sample (*N=68)* completed the follow-up telephone assessment (average days = 10.4). There were no significant differences by group in rate of participation for the follow-up questionnaire $F(2, 81) = 0.53$, $p = .59$. There was a significant effect of time on craving, with participants reporting significantly lower levels at follow-up, $F(1,65) = 6.82$, $p = .01$. Similarly, compared to the number of self-reported drinks/week disclosed at baseline, the number of drinks/week reported at follow-up was significantly fewer $F(1,65) = 25.63$, $p < .01$. Again, no group × time interactions were present.

CHAPTER 4

DISCUSSION

The goal of the present study was to test the efficacy of a mindfulness-based strategy in reducing craving for alcohol. When compared to passive and active control groups, it was predicted that a mindfulness-oriented strategy would have the greatest efficacy in reducing acute desire to drink. Moreover, because the MND group was instructed to try to accept their urges rather than being critical or judgmental of them, individuals in this condition were predicted to have the greatest reduction in distress from their urges. Contrary to predictions, the MND strategy was not superior at reducing desire to drink or distress caused by urges. Instead, individuals in the DST group were superior to both the MND and CTL groups. Overall, the changes in craving, urge distress, and mood reported by the DST group were unparalleled by the MND and CTL groups. Over the course of the exposure-extinction period, the DST group reported decreases in desire to drink and distress from urges that were nearly triple what was reported in the MND or CTL groups. Similarly, the mood of the CTL and MND groups remained fairly constant over the course of the session while the DST group experienced significant decreases in unpleasant mood states and increases in pleasant ones. Notably, many of these gains occurred early on in the session. Soon after the groups were given instructions about how to manage their alcohol cravings, the DST group had greater success with regard to self-reported reductions in desire to drink and urge distress. Similarly, the DST group became less responsive to alcohol cues when compared to the other groups. Unlike individuals in the MND group, who

remained reactive during the second alcohol cue exposure, and individuals in the CTL group, who remained reactive during both the second and third alcohol cue exposures, participants in the DST group did not report increases in craving following either of these cue exposures. Of note, these differences were only evident when considering self-report data. Significant interactions were not present for psychophysiological arousal; fluctuations in HR did not occur differentially between groups.

Although interest in using mindfulness in the treatment of addictive behavior has burgeoned, the results of this study did not support the efficacy of a mindfulness-based strategy for reducing cravings for alcohol nor for changing the way in which a craving is experienced. While this is one of the first laboratory studies involving cue-elicited craving for alcohol and mindfulness, it is not the first empirical study that did not find support for a using a mindfulness coping strategy for acute cue-elicited cravings. Research has indicated that individuals instructed to use urge surfing techniques were no more effective at reducing their craving for cigarettes than a control group (Bowen & Marlatt, 2009). Similarly, a mindfulness strategy of accepting urges for cigarettes was not found to be superior at reducing craving than a strategy involving ignoring thoughts (Rogojanski, Vettese, & Antony, 2011). Thus, results of the present study seem to replicate similar preliminary findings that suggest mindfulness-based strategies may not be the most effective at reducing acute cravings for a substance.

Rather than mindfulness being the most effective, these findings supported the use of a distraction coping strategy, initially intended as an active control manipulation. The DST group was instructed to utilize active strategies that were behavioral (e.g., do something else) and cognitive (e.g., think about something else) in nature. The current findings converge with previous research that has supported the use of active cognitive and behavioral strategies (e.g.,

exercising, reading, using positive self-talk; Moser & Annis, 1996). Findings suggest that engaging in an active task, rather than relying on cognitive distraction alone, is more effective at reducing craving (Daniel, Cropley, & Fife-Schaw, 2006). Equally, research investigating the role of attention versus distraction when attempting to delay gratification has demonstrated that fixing attention on a desired reward is likely to thwart a successful delay whereas diverting attention and distracting oneself are likely to facilitate it. In one experiment, children who paid more attention to a desired reward, in this case a "Good Player" award, were able to withstand their temptation for the shortest period of time (Peake, Hebl, & Mischel, 2002).

Additional research has examined addictive behavior and active behavioral strategies more specifically. One study demonstrated that "keeping busy" was a strategy frequently endorsed by individuals who had successful stopped smoking cigarettes (Richter, McCool, Okuyemi, Mayo, & Ahluwalia, 2002). In another study of cigarette smokers who had briefly abstained from smoking, participants were asked to practice a distracting activity (i.e., seated isometric exercises like fist clenching), to use a MBSR strategy (i.e., focused attention on bodily sensations), or to sit passively while craving a cigarette (Ussher, West, Doshi, & Sampuran, 2006). Similar to the present study, in which participants attempting to distract themselves had effects that were quickly observable and persisted, findings indicated that individuals using active behavioral techniques (i.e., seated exercises) had statistically significant reductions in craving both immediately following the intervention and after a five minute delay.

While advice directly advocating that individuals distract themselves from temptations they are experiencing is less widely emphasized in the literature, several interventions designed to help individuals reduce their drinking suggest that distracting oneself with another activity may helpful (Miller, 2004; Monti et al., 2002; NIH, 2010). This type of suggestion typically

includes advice like “find some activity to take your mind off drinking [that will occupy] your mind enough that you will be distracted from the urges,” (Monti et al., 2002, p. 99). In fact, even in DBT, a treatment considered to be mindfulness-oriented, distraction techniques are recommended as a way to increase distress tolerance. These include activities like refocusing one’s attention on something else, distracting oneself with other thoughts, and pushing away from a situation by directly leaving it or blocking it in one’s mind (Linehan, 1993).

Interestingly, these recommendations may seem somewhat paradoxical from the perspective of Ironic Process Theory (Wegner, 1994). This theory suggests that trying not to think of something may inadvertently increase the rate at which it is thought of because ensuring that the unwanted thought (e.g., a white bear, a desire for a drink) is not present requires its maintenance in memory. In the area of addictive behavior, however, the relationship between thought suppression and increased frequency of unwanted thoughts has not been wholly supported. Research has indicated that asking participants to try not to think about smoking while they talked aloud, a seemingly distracting activity, did not result in elevated desire to smoke a cigarette (Erskine et al., 2012). Equally, in the present study, individuals instructed to try to distract themselves from cravings reported the lowest level of craving. It should be noted, however, that, although participants in these studies may have used cognitive avoidance strategies not dissimilar from thought suppression, they likely used these strategies in conjunction with other active behavioral and cognitive coping responses. Redirecting thoughts to other domains can be seen as an active cognitive strategy and may be meaningfully different from a strategy of exclusively attempting to suppress or ignore thoughts.

In addition to the primary findings reported, this study has several collateral findings of note. First, as a result of the alcohol extinction protocol and study participation, individuals

reported greater confidence in their ability to resist having a drink in a variety of high-risk situations. Possibly related, when contacted one week after the study, participants reported lower levels of craving and reduced alcohol consumption. Thus, regardless of randomization to strategy assignment, alcohol cue exposure with response prevention was associated with greater confidence in one's ability to refuse a drink and, in the short term, individuals reported having lower levels of craving and consuming less alcohol. Second, this study provides support for urge distress as a novel index of motivation for alcohol. Cravings and urge distress followed very similar patterns in this study that were not exhibited when considering relatively stable levels of pleasant and unpleasant mood states over the course of the session. This suggests that urge distress is distinct from mood in general. Further, it is an indication that, even in a non-treatment-seeking sample, cravings are meaningfully unpleasant and bothersome.

While the findings of the current study provide some preliminary support for the use of active behavioral coping strategies, rather than mindfulness-based strategies, these findings should be considered in the context of the study's strengths and limitations. With regard to strengths, this study was one of the first experimental studies to measure the direct effects of a mindfulness coping strategy on acute cravings for alcohol. The study was adequately powered to detect effects, manipulation checks supported the internal validity, and motivation for alcohol was assessed in a number of different ways. There were also various limitations to this study. First, the sample was neither treatment-seeking nor a clinical population and caution should be taken when generalizing these findings to other groups. Similarly, this study only targeted one type of craving, cue-elicited craving, and mindfulness instructions reflected a skills-based approach. Results may vary when targeting other types of craving or when other mindfulness-oriented interventions, such as meditation, are employed. Finally, with regard to decreases in

alcohol craving and alcohol consumption reported at follow-up, it is possible that differences in modalities (i.e., telephone vs. electronic questionnaire) or demand characteristics may have influenced responding.

In the present study, a mindfulness strategy of observing and accepting craving was not effective at reducing craving or distress from craving above and beyond normal decay occurring with the passage of time. Instead, this study found that active distraction strategies, such as reading a magazine, were more effective at reducing craving, distress from craving, and unpleasant mood states. There are several possible considerations that should be made with regard to the lack of support for a mindfulness coping strategy in this study. First, the ease or difficulty of implementing mindfulness and distraction strategies may vary as a function of diagnostic severity. Second, although the mindfulness group did not report that their strategy was any more difficult than the distraction group, like many skills, mastery of mindfulness techniques may require repetition and practice. Therefore, there may be a learning curve involved in noticing, accepting, and tolerating urges. If so, multiple sessions and/or more extensive practice of mindfulness skills may be more likely to produce an implementation of mindfulness-based skills that is more effective. Thus, it is important not to overgeneralize these findings. Nonetheless, this study echoes concerns that research has not provided support for the effectiveness of mindfulness for substance abuse (Appel & Kim-Appel, 2009). Methodologically rigorous research studies continue to be needed to better understand what components of mindfulness (accepting emotions, viewing an urge as distinct from the self, being aware of an urge without behaving impulsively), if any, are effective at reducing craving and/or reducing distress from craving so that urges can be experienced and tolerated without alcohol misuse necessarily ensuing.

The goal of the present study was to investigate whether, in the presence of alcohol cues, heavy drinkers who were asked to use a mindfulness strategy would report less of a desire to drink and would be less distressed by their cravings for alcohol than individuals in control groups. Analyses revealed that individuals using a distraction strategy, in the active control group, had a significantly greater reduction in craving, distress from craving, and negative affect than individuals in the mindfulness group. This replicates previous investigations that have indicated that taking one's mind off a desired object, via distraction, may be more effective than mindfully observing and accepting craving. Future research should continue to investigate the effectiveness of mindfulness coping strategies, as relatively little experimental research has been conducted in this domain. Similarly, continued investigation of the short and long term benefits of active behavioral coping strategies and cognitive avoidance coping strategies may be useful to better understand and potentially replicate these results.

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Table 1

Baseline Sample Characteristics

	Total Sample (N = 84)	MND (n = 28)	DST (n =28)	CTL (n =28)
Sex	Male (50%) Female (50%)	Male (50%) Female (50%)	Male (50%) Female (50%)	Male (50%) Female (50%)
Race	White (85%) Black (6%) Asian (6%) Pacific Islander (1%) Mixed Race (2%)	White (75%) Black (7%) Asian (11%) Pacific Islander (4%) Mixed Race (4%)	White (89%) Black (7%) Asian (4%) Pacific Islander (0%) Mixed Race (0%)	White (89%) Black (4%) Asian (4%) Pacific Islander (0%) Mixed Race (4%)
Household Income	$45,000-$60,00 (median)	$45,000-$60,00 (median)	$45,000-$60,00 (median)	$45,000-$75,000 (median)
Years of Education	15.30(1.56)	15.43(1.91)	15.14(1.41)	15.32(1.33)
Age	22.43 (1.76)	22.32(1.59)	22.82(1.87)	22.14(1.80)
Drinks/week	24.59(12.72)	28.23(13.85)	22.98(13.79)	22.55(9.72)
FFMQ Observe	28.61 (5.42)	28.82 (5.50)	28.68 (5.31)	28.32 (5.63)
FFMQ Describe	28.27 (5.84)	28.14 (6.45)	29.61 (4.43)	27.07 (6.34)
FFMQ Aware	25.11 (5.24)	24.32 (5.50)	25.50 (4.58)	25.50 (5.66)
FFMQ Nonjudge	26.27 (5.82)	25.71 (5.99)	25.82 (6.77)	27.29 (4.55)
FFMQ Nonreact	28.23 (4.20)	22.00 (4.95)	21.61 (3.27)	22.07 (4.35)
Drink Refusal SE	76.46 (20.66)	83.07 (21.71)	88.96 (13.21)	83.83 (19.37)

Note. FFMQ = Five Factor Mindfulness Questionnaire; SE= self-efficacy, MND = mindfulness, DST = distraction, CTL = control.

Table 2

Study Outline by Time Point

Study Time Point	**Assessment**
1. Informed Consent	
2. Baseline Assessment	Baseline
3. Exposure to Neutral Cues	
4. Post-Neutral Assessment	**#1**
5.Alcohol Cue Exposure #1	
6. Post Alcohol Cue Assessment #1	**#2**
7. Assigned Coping Strategy/ Listen to explanatory recording	
8. Extinction Period #1	
9. Post Delay Assessment #1	**#3**
10. Alcohol Cue Exposure #2	
11. Post Alcohol Cue Assessment #2	**#4**
12. Extinction Period #2	
12. Post Delay Assessment #2	**#5**
13. Alcohol Cue Exposure #3	
14. Post Alcohol Cue Assessment #3	**#6**
15. Extinction Period #3	
16. Post Delay Assessment #3	**#7**
17. Exit assessment & manipulation check	Exit
18. Debrief & Feedback	
19. Conclusions & Payment	
20. Follow-up Telephone call	Follow-up

Table 3

Adherence to the Instructional Set Reported Following Alcohol Exposure & Extinction

	MND			DST		
	F	*p*	Follow-up	*F*	*p*	Follow-up
EXT #1	4.75	.01	MND>DST/CTL	9.26	<.001	DST>MND
EXP #2	9.15	<.001	MND>DST/CTL	21.45	<.001	DST>MND/CTL
EXT #2	11.58	<.001	MND>DST/CTL	9.24	<.001	DST>MND/CTL
EXP #3	10.75	<.001	MND>DST/CTL	18.70	<.001	DST>MND/CTL
EXT #3	17.69	<.001	MND>DST/CTL	10.45	<.001	DST>MND/CTL

Note. EXT = extinction period. EXP = alcohol exposure period. MND = Mindfulness Group. DST= Distraction Group. CTL=Control Group.

Table 4

Manipulation Check Questions

	Group Mean					
During today's study I was asked…	M	D	C	*F*	*p*	Follow-up
General Questions (1= TRUE, 2=FALSE)						
…to pick up the drink in front of me	1.00	1.00	1.04	1.00	.37	--
…to notice how the glass feels in my hand and the color of the beverage	1.00	1.00	1.00	--	--	--
…to inhale the smell of the drink	1.00	1.00	1.00	--	--	--
Mindfulness Questions (1= TRUE, 2=FALSE)						
…not to label or evaluate my thoughts as good or bad	1.00	1.89	1.96	179.74	<.001	M<D/C
…to accept my thoughts without judging them	1.00	1.86	1.96	144.22	<.001	M<D/C
…to allow craving, frustration, and discomfort to be present	1.00	1.75	1.93	77.47	<.001	M<D/C
Distraction Questions (1= TRUE, 2=FALSE)						
…to distract myself in order to take my mind off drinking	1.96	1.00	1.71	85.043	<.001	D<M/C
…to try to make my urges to drink go away	2.00	1.14	1.71	47.25	<.001	D<M/C
…to find ways to distract myself	1.96	1.00	1.57	68.178	<.001	D<M/C
Rate how much you agree with the following (1=Strongly Disagree, 5=Strongly Agree):						
I was given a specific strategy to use to cope with any cravings for alcohol I experienced	4.43	3.89	1.32	95.32	<.001	M/D<C
I intentionally tried to accept wanting to drink without judging it to be a good or bad thing and was able to	4.29	3.54	3.04	13.27	<.001	M>D/C
I intentionally tried to distract myself from wanting to drink and was able to	1.89	4.50	3.79	62.00	<.001	D>M/C

Note. M = Mindfulness Group. D= Distraction Group. C=Control Group.

Table 5

Comparisons of Initial Reactivity Using 3 x 2 Mixed ANOVAs (group x time) from Neutral to Alcohol Cues

Variable	**Condition**			**Time**			**C × T**		
	F	*p*	η^2_p	*F*	*p*	η_p^2	*F*	*p*	η^2_p
Craving	1.85	.16	.04	109.32	<.01	.57	1.40	.25	.03
Urge Distress	.93	.40	.02	100.13	<.01	.55	.84	.43	.02
Positive Affect	2.16	.12	.05	2.46	.12	.03	.34	.71	.01
Negative Affect	1.08	.35	.03	2.28	.13	.03	1.51	.23	.04
Heart Rate	.31	.74	.01	40.81	<.01	.34	.45	.64	.01

Table 6

Comparisons of Responses Post-Strategy Assignment Using 3 x 6 Mixed ANOVAs (group x time) During Alcohol Cue Exposures and Extinction Periods

Period	**Condition**			**Time**			**C × T**		
	F	*P*	η^2_p	*F*	*P*	η^2_p	*F*	*p*	η^2_p
Craving	6.52	.00	.14	38.84	<.01	.32	10.62	.00	.21
Urge Distress	1.95	.15	.05	34.50	<.01	.30	6.51	.00	.14
Positive Affect	1.18	.31	.03	3.70	.06	.04	3.23	.04	.07
Negative Affect	1.74	.18	.04	9.52	<.01	.11	4.71	.01	.10
Heart Rate	.24	.79	.01	11.47	<.01	.12	.15	.86	.00

Table 7

Mixed ANOVAs for Primary Dependent Variables Using 3 x 2 Mixed ANOVAs (group x time) of Adjacent Time Points

Period	**Condition**			**Time**			**C × T**		
	Craving								
	F	*P*	η^2_p	*F*	*p*	η^2_p	*F*	*p*	η^2_p
EXT #1	4.02	.02	.09	35.16	<.01	.30	5.14	<.01	.11
EXP#2	7.83	<.01	.16	5.95	.02	.07	4.90	.01	.11
EXT#2	10.22	<.01	.20	25.30	<.01	.24	.02	.98	.00
EXP#3	9.88	<.01	.20	6.64	.01	.08	.73	.49	.02
EXT#3	12.29	<.01	.23	15.80	<.01	.16	.41	.67	.01
	Urge Distress								
	F	*P*	η^2_p	*F*	*p*	η^2_p	*F*	*p*	η^2_p
EXT #1	1.38	.26	.03	41.05	<.01	.34	3.81	.03	.09
EXP#2	2.65	.08	.06	8.16	.01	.09	2.93	.06	.07
EXT#2	3.42	.04	.08	24.94	<.01	.24	1.51	.23	.04
EXP#3	3.98	.02	.09	8.38	<.01	.09	.05	.95	.00
EXT#3	4.96	.01	.11	10.97	<.01	.12	.98	.38	.02

Note. EXT = extinction period. EXP = alcohol exposure period. MND = Mindfulness Group, DST= Distraction Group, CTL=Control Group

Table 8
Simple Effects for Primary Dependent Variables

Period	Mindfulness			Distraction			Control		
	Craving								
	t	*p*	*r*	*t*	*p*	*r*	*t*	*p*	*r*
EXT #1	1.40	.17	.26	5.74	.00	.74	3.71	.00	.58
EXP#2	-2.40	.02	.42	.93	.36	.18	-3.93	.00	.60
EXT#2	2.78	.01	.47	3.25	.00	.53	2.80	.01	.47
EXP#3	-1.05	.30	.20	-1.09	.28	.21	-2.63	.01	.45
EXT#3	1.78	.09	.32	2.47	.02	.43	2.93	.01	.49
	Urge Distress								
	t	*p*	*r*	*t*	*p*	*r*	*t*	*p*	*r*
EXT #1	2.51	.02	.44	4.91	.00	.69	3.86	.00	.60
EXP#2	-1.15	.26	.22	-.12	.91	.02	-3.78	.00	.59
EXT#2	1.34	.19	.25	3.93	.00	.60	4.12	.00	.62
EXP#3	-1.40	.17	.26	-2.37	.03	.42	-1.81	.08	.33
EXT#3	2.34	.03	.41	2.14	.04	.38	1.17	.25	.22

Note. EXP=exposure to alcohol cues assessment. EXT=extinction assessment.

Figure 1
Study Schematic

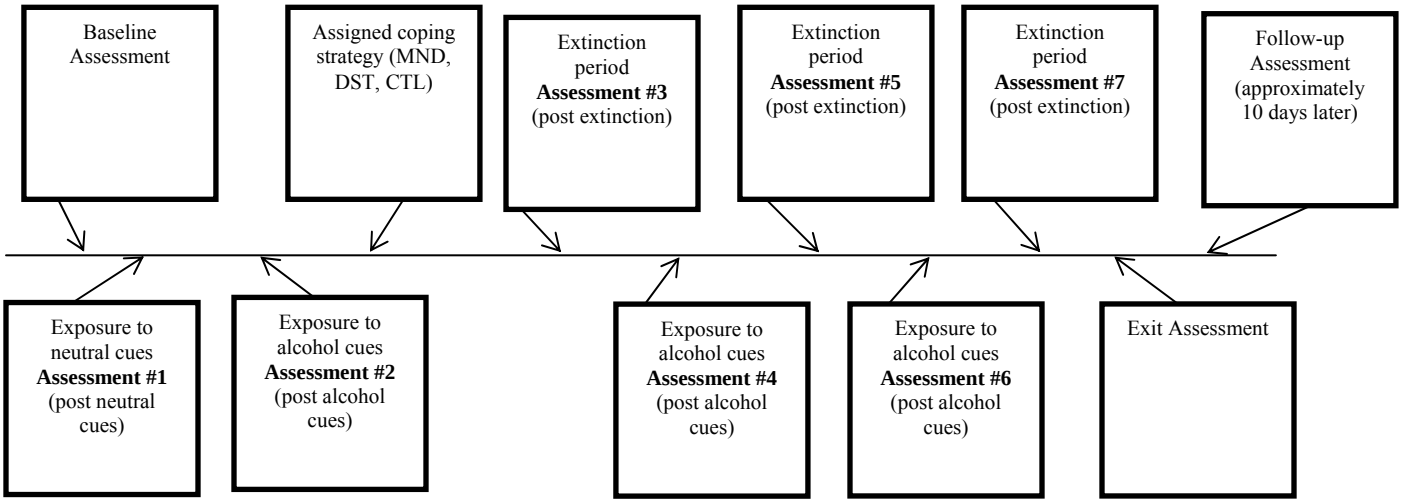
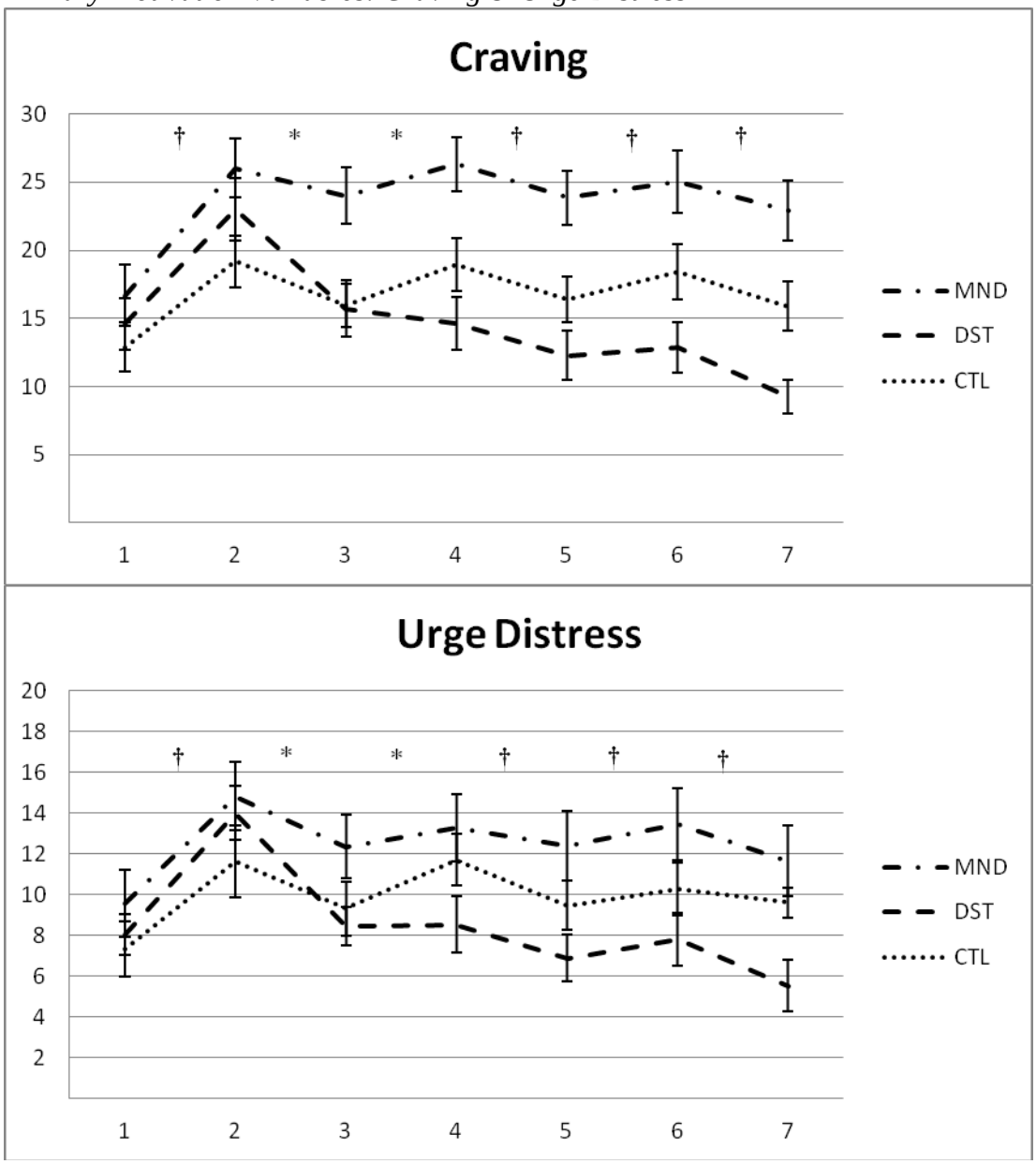


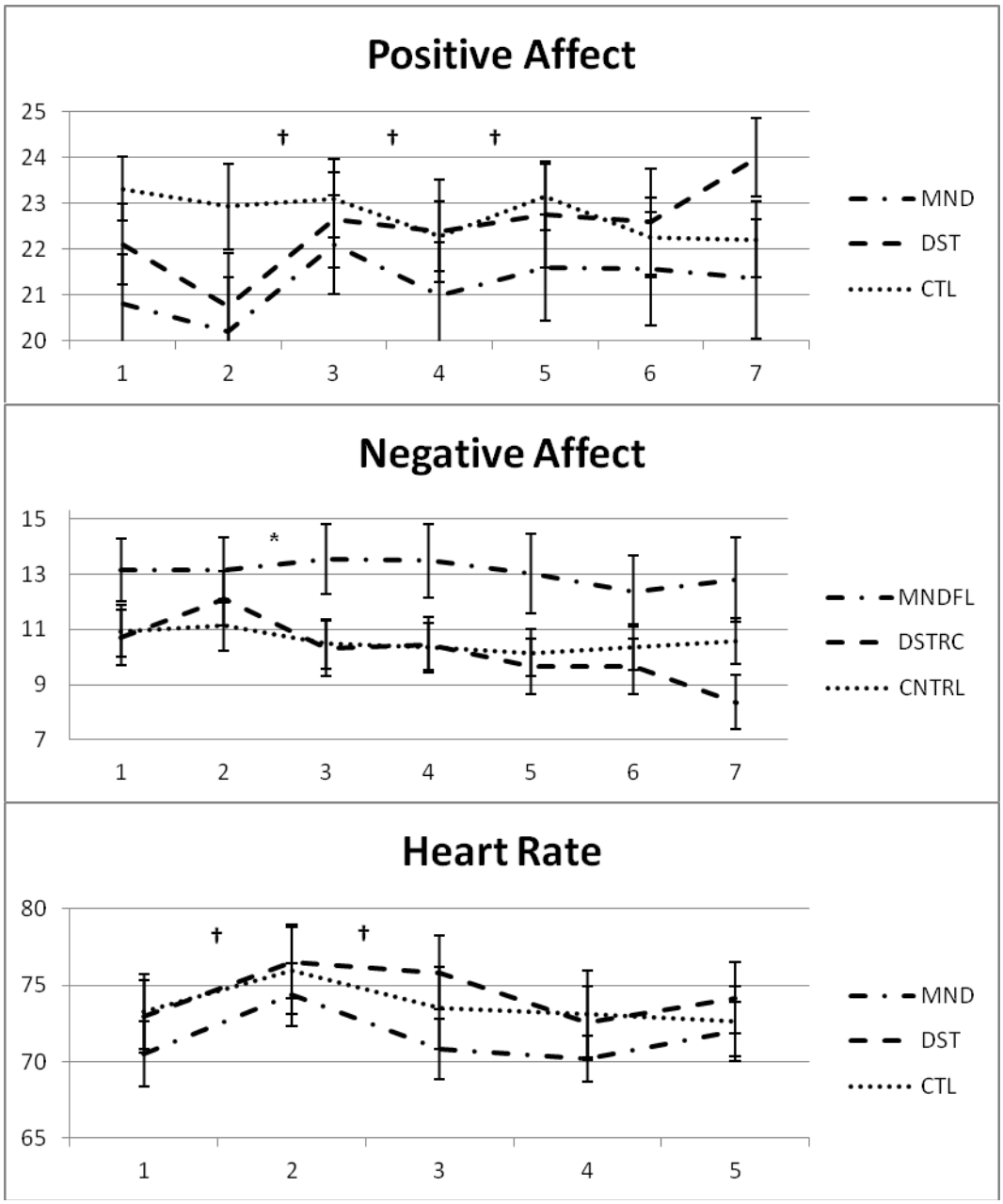
Figure 2

Primary Motivation Variables: Craving & Urge Distress



Note. MND = Mindfulness Group, DST= Distraction Group, CTL=Control Group. * = significant interaction. † = significant main effect.

Figure 3
Secondary Motivation Variables: Positive and Negative Affect & Heart Rate



Note. MND = Mindfulness Group, DST= Distraction Group, CTL=Control Group.
* = significant interaction. † = significant main effect.