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Distress Tolerance as a Potential Target for Change: The Relationship Between Distress Tolerance, Craving, and Alcohol Consumption in a Lab-based Experiment

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Distress Tolerance as a Potential Target for Change: The Relationship Between Distress Tolerance, Craving, and Alcohol Consumption in a Lab-based Experiment

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Abstract

Distress tolerance (DT) has recently been studied as a potential catalyst for the development of alcohol use disorder (AUD). Research exploring the relationship between DT and craving is limited and has primarily focused on nicotine craving. Furthermore, there are no current studies examining the relationship between DT and alcohol consumption. This study was designed to fill this gap in the literature, which may shed light on a potentially important target for alcohol use treatment. Additionally, the role of mindfulness was explored in the context of the relationship between DT and alcohol craving and consumption, with the intention of expanding on the existing literature demonstrating the utility of mindfulness-based interventions for AUD. This study consisted of 71 participants age 21-35, recruited as part of a larger research study. Trait DT, trait mindfulness, and an initial craving rating were assessed at baseline. Individuals were then given a negative mood induction task. After the mood induction, individuals were given measures of momentary distress intolerance and craving. Next, participants were given an alcohol taste-task to measure ad libitum alcohol consumption, after which they completed a measure of state mindfulness. Individuals with higher momentary distress intolerance after the mood induction had a greater increase in craving from pre- to post- mood induction; there was no significant relationship between trait DT and craving. Trait DT and momentary distress intolerance were not predictive of alcohol consumption in this study. Additionally, mindfulness measures did not moderate the relationship between DT measures and alcohol craving or consumption. Further research is needed to better understand the relationship between DT and alcohol craving and alcohol consumption, as well as the potentially important role of mindfulness in the treatment of AUD.

Keywords: Distress tolerance, craving, alcohol consumption, alcohol use, mindfulness

Contents

Introduction

According to the National Survey on Drug Use and Health (NSDUH), 86.4% of people 18 years of age or older in the United States (US) have drank alcohol and 6.2% of individuals in this age group meet current diagnostic criteria for alcohol use disorder (AUD; Substance Abuse and Mental Health Services Administration, 2015). Excessive alcohol use may lead to mental and physical health repercussions and has an immense economic burden in the US (Sacks et al., 2015). Potential problems related to alcohol use highlight the need to better understand factors that may be important in the development and maintenance of AUD. Distress tolerance (DT), which is defined here as the ability to withstand negative emotions or affective states (Leyro, Zvolensky, & Bernstien, 2010; Simons & Gaher, 2005), has recently gained traction as a target mechanism involved in AUD. Specifically, low DT may increase risk of alcohol use and potential development of an AUD (Leyro et al., 2010). The current study investigated the role of DT in craving and alcohol consumption following a mood induction in a laboratory-based setting, as a way to understand how low DT might increase risk for AUD.

DT is a growing topic of interest in clinical research. DT has been conceptualized as either the perceived capacity or behavioral capacity to withstand distress (Zvolensky et al., 2010). Under the conceptual umbrella of perceived capacity to withstand distress, is the perceived ability to withstand negative emotional states, which is the definition of DT used in this study. This particular conceptualization of DT has been implicated in the development and maintenance of many psychological disorders and may be a valuable target for integrated treatment strategies (Leyro et al., 2010). Utilizing this definition of DT, Simons and Gaher (2005) identify four key aspects of DT; individuals with low DT: (1) find distressful and negative emotions to be aversive; (2) perceive a problem with the experience of distressing

emotions; (3) avoid negative emotions and try to ameliorate negative affective experiences quickly but not always effectively; and (4) are overwhelmed by distressing feelings, resulting in a disruption in functioning.

Distress Tolerance and Alcohol Misuse

Recent studies have shown significant associations between low DT and alcohol-related problems. A study by Simons and colleagues (2018) investigated the role DT may play in the relationship between maladaptive cognitive schemas (abandonment, defectiveness/shame, and insufficient self-control) and alcohol problems in college students. This study found that DT partially mediated the relationship between the abandonment and insufficient self-control schemas and alcohol problems and moderated the relationship between defectiveness/shame and alcohol problems (Simons, et al., 2018). Another study, looking at female college students, found that lower subjective DT was significantly related to increased negative consequences from alcohol use (Holzhauer, Wemm, & Edelgard, 2017). Furthermore, other studies have demonstrated that in individuals with co-occurring depression, low distress tolerance may be an important risk factor for the development of alcohol problems (Buckner, Keough, & Schmidt, 2007; Gorka, Ali, & Daughters, 2012).

The aversion to and avoidance of negative emotional states, as is seen in individuals with low DT, may be a motivation to use alcohol. A well-known and supported theory of drinking motives posits that individuals engage in drinking to either increase positive outcomes or a decrease in negative outcomes (Cooper, Frone, Russel, & Mudar, 1995; Cox & Klinger, 1988; Kuntsche, Knibbe, Gmel, & Engels, 2005). Specifically, individuals may drink to increase positive affect with the expectation of internal positive enhancement (i.e., enhancement motives), or they may drink for the perceived positive social outcomes of drinking (i.e., social motives).

Alternatively, individuals may drink to decrease negative affect or to cope with negative internal difficulties (i.e., coping motives), or to conform or decrease negative social outcomes (i.e., conformity motives). In college students, coping motives to drink has been associated with alcohol-related problems (i.e. missing school because of drinking), even after controlling for alcohol consumption (Kassel, Jackson, & Unrod, 2000). Another study found that coping motives to drink moderated the relationship between alcohol use and alcohol-related problems, also in college students (Martens et al., 2008). Individuals with lower DT, in this model, are assumed to consume alcohol in order to decrease negative emotions or affective states. Several studies have investigated DT in the context of coping motives to drink.

One study found that subjective appraisal of distress (a domain of DT) significantly predicted alcohol-related problems in a sample of college students, aged 18-23 (Khan et al., 2018). Furthermore, the authors found that drinking to cope with negative affect mediated the relationship between other DT domains (i.e., tolerance of emotional distress, attention absorbed by negative affect, and distress regulation strategies) and alcohol-related problems. Another more recent study found that low DT was significantly associated with alcohol-related consequences, alcohol use quantity, and alcohol use frequency, and that this was mediated by endorsement of coping motives to drink (Wahesh, Moreton, & McKenchnie, 2020). This suggests that the inability to withstand negative affective conditions may impact an individual's drive to drink. Additionally, a study by Vujanovic, Marshall-Berenz, and Zvolensky (2011) found that trauma-exposed individuals with higher levels of impulsivity reported lower levels of DT, and that DT mediated the relationship between impulsivity and coping motives to drink in these individuals. Overall, previous research demonstrates a relationship between DT and coping

motives to drink, increased use of alcohol, and more alcohol-related problems or negative outcomes associated with drinking.

Considering the breadth of findings showing a link between DT and coping motives to drink, I expect to see a relationship between low DT and likelihood to drink when experiencing negative affectivity. Interestingly, a study by Simons and colleagues (2005) that examined affectivity related to alcohol consumption and related problems using ecological momentary assessment methods, found that negative affectivity during the day was associated with more alcohol consumption at night; however, contrary to researchers' hypotheses, DT did not significantly moderate this relationship. Additionally, this study found that DT moderated the relationship between positive affectivity and alcohol consumption, such that individuals with lower DT showed a weaker positive association between positive affect and alcohol consumption than individuals with higher DT (Simons et al., 2005). This research indicates a need to further explore the role of DT in drinking outcomes, as it may be an important target for the treatment of alcohol use, especially in the context of negative affective states.

Alcohol craving is a precursor for in-the-moment drinking behavior and may be an important risk factor for the maintenance of AUD (Pombo, et al., 2016; Treloar & Miranda, 2018); therefore, the potential of role of DT in craving may be an important avenue of exploration. Literature examining the relationship between DT and alcohol craving is limited, although extant literature has found that lower DT is associated with increased cigarette craving (Matthew et al., 2018; Trujillo et al, 2017). One study found that lower experiential avoidance and better DT were each negatively associated with drug and alcohol craving (Shorey, et al., 2017); however, there has been no research to date investigating the relationship between DT

and alcohol craving or drinking behavior in the moment in response to negative affect specifically.

Mindfulness to Target Low Distress Tolerance

Mindfulness is generally defined as non-judgmental awareness of the present moment (Kabbat-Zin, 1990). Bishop and colleagues (2004) propose a two-component model of mindfulness including: (1) self-regulation of attention, which includes awareness of experience, and (2) orientation to experience in a curious, open, and accepting posture. Both of these aspects of mindfulness may be relevant to the treatment of alcohol and substance use. Mindfulness interventions involve recognition of emotional states and distressing experiences and encourage approaching these experiences with openness and acceptance. This attribute of mindfulness may be a useful for individuals with low DT, who often avoid or are threatened by negative emotional or physiological states (Lotan, Tanay, & Bernstein, 2013).

Mindfulness-Based Relapse Prevention (MBRP; Bowen, Chawla, & Marlatt, 2011) is a new-wave therapy for alcohol and other substance use disorders that integrates cognitive behavioral therapy for relapse prevention and mindfulness techniques (Sudhir, 2018). MBRP uses mindfulness to manage cravings and negative emotional states, which are believed to contribute to the maintenance and relapse of alcohol and substance use disorders (Witkiewitz, Bowen, Harrop, Douglas, Enkema, & Sedgwick, 2014). Efficacy trials of MBRP have demonstrated significantly lower rates of substance and alcohol use, reductions in craving, and increases in acceptance and awareness when receiving MBRP compared to treatment as usual (Bowen et al. 2009; Bowen et al., 2014; Hsu, Collins, & Marlatt, 2013; Witkiewitz, Bowen, Douglas, & Hsu, 2013). One possible process by which MBRP reduces alcohol and drug-related outcomes is by increasing DT. Hsu and colleagues (2013) found that individuals with low DT

who received MBRP had greater reductions in alcohol or other drug use compared to individuals with low DT who received treatment as usual. However, these effects were not maintained at 4-month follow-up (Hsu, Collins, & Marlatt, 2013). Furthermore, many treatments for smoking cessation focus on improving DT by utilizing mindfulness approaches that specifically focus on acceptance (Brown et al., 2018; Otto et al., 2020).

Recent studies have looked at the role of DT in alcohol and substance use outcomes, and this relationship has further been explored in the context of MBRP. However, no studies to date have examined how DT predicts ad-libitum alcohol consumption or craving when responding to negative emotions. In this study, mindfulness was explored because it may help explain how individuals deal with distress and may be a potential protective factor as well as a treatment target. Examining the relationship between DT and mindfulness could further develop our understanding of the risk factors for alcohol use and may be helpful in developing targeted interventions for AUD.

Current Study

This study further explored the relationship between DT, alcohol craving, and alcohol consumption in a lab-based experiment. Based on past research suggesting a relationship between low distress tolerance and AUD, I hypothesized that individuals with lower levels of general DT (Hypothesis 1a) and higher momentary distress *in*tolerance (DI) following a negative mood induction (Hypothesis 1b) would have a greater increase in alcohol craving from pre- to post-negative mood induction. Additionally, I hypothesized that individuals with lower general DT (Hypothesis 2a) and higher momentary DI post-mood induction (Hypothesis 2b) would consume more alcohol after a negative mood induction. In addition to these primary hypotheses, I tested a set of secondary hypotheses examining the role of mindfulness in the associations

between DT, craving, and alcohol consumption. I predicted that momentary mindfulness during the ad-libitum drinking task would moderate the association between general DT (Hypothesis 3a) and momentary DI (Hypothesis 3b) and alcohol consumption, such that individuals with low DT or high DI and low momentary mindfulness would consume more alcohol. Additionally, I predicted that trait mindfulness would moderate the association between general DT (Hypothesis 4a) and momentary DI (Hypothesis 4b) and alcohol craving from pre- to post- negative mood induction, such that individuals with low DT or high DI and low trait mindfulness would have a greater increase in craving. Specifically, mindfulness measures chosen for this study focused on the awareness of experiences; it was hypothesized that increased awareness would allow individuals to better regulate and tolerate distress in-the-moment and would decrease craving and likelihood to drink.

Method

Participants

Participants were 71 adults recruited from the University of Arkansas and the surrounding community as part of a larger study funded by the Arkansas Biosciences Institute (ABI). As part of the larger ongoing ABI study aims, all participants met criteria for being relatively "high" (n = 46) or "low" (n = 25) in trait negative urgency (see Procedures for more information). Alcohol was administered during the study; therefore, all participants were 21 years of age or older. Individuals with a history of alcohol use problems, currently in treatment for alcohol use, or trying to abstain from alcohol were excluded from the study. Participants must have consumed alcohol at least one time in the past month to participate in the study, but not within 24 hours of participation. Additionally, individuals taking medications or with medical conditions that are contraindicated with alcohol were not allowed to participate. Other exclusion

criteria included: substance use disorders (other than alcohol), recent (past month) suicidality or physical violence toward others, bipolar disorder, and psychosis. Because the study participants consumed alcohol, female participants who were pregnant or breastfeeding were not eligible to participate. Additionally, female participants were required to complete a pregnancy test to rule out pregnancy before study participation.

All participants were between 21 and 35 years of age (M = 24.53, SD = 3.56). Gender distribution of the sample was 59.15% female. The majority of participants were students (84.51%). Reported race and ethnicity were 78.87% White (non-Hispanic), 8.45% Hispanic or Latino, 2.81% Black or African American, 2.81% American Indian or Alaska Native, and 4.22% reported identifying with more than one race or ethnicity. Sample demographics are summarized in Table 1. All individuals included in the final dataset passed mood induction and "taste-task" deceptions. Most participants (69.01%) indicated liking beer "Neutral" or better; individuals who indicated they did not like beer were not excluded from the analyses.

Measures

Laboratory Screening Interview

To assess for the presence of exclusion criteria related to suicidality, mania, substance use disorders, and psychosis, select modules were administered from the MINI-International Neuropsychiatric Interview (Version 7.0.2) for DSM–5 (Sheehan et al., 1998). The MINI is a brief structured interview that assesses psychiatric symptoms and diagnoses. This interview has demonstrated strong inter-rater reliability, sensitivity, and specificity for most diagnostic categories (Lecrubier et al., 1997).

Additionally, the Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001; Saunders, Aasland, Babor, De La Fuente, & Grant, 1993)

was used to screen out participants who do not use alcohol (total score < 1) and those with potentially problematic alcohol use requiring treatment (total score > 15). The AUDIT is a 10-item scale that measures alcohol use, alcohol-related problems, and symptoms of alcohol dependence over the past year. The AUDIT has shown good validity and reliability as a screening measure for detecting at risk drinking across many different settings (Babor & Robaina, 2016; Berner et al., 2007).

Background Questionnaires

Participants provided responses to demographic items assessing gender, age, race/ethnicity, marital status, sexual orientation, and employment status (see Table 1 for a summary of sample demographics), followed by measures of typical DT and mindfulness.

Distress Tolerance Scale. The Distress Tolerance Scale (DTS; Simons & Gaher, 2005) is a 15-item scale that measures emotional DT using a scale from 1 (*strongly agree*) to 5 (*strongly disagree*). The DTS has a general DT factor that is measured by averaging all items on the scale. This general DT factor was used to measure levels of DT typically experienced by the respondent. Examples of items are "I can't handle feeling distressed or upset" and "I'll do anything to avoid feeling distressed or upset." The DTS has been used in several other studies examining DT and has demonstrated reliability, convergent and discriminant validity, criterion validity, and construct validity ($\alpha = 0.92$; Leyro, Bernstein, Vujanovic, McLeish, & Zvolensky, 2010; Simons & Gaher, 2005).

Mindful Attention Awareness Scale. The Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) is a measure of trait mindfulness that gives statements about everyday experiences and how frequently they are experienced (e.g., "I find myself doing things without paying attention," "I find it difficult to stay focused on what's happening in the present"), which

are rated on a scale from 1 (*almost always*) to 6 (*almost never*). The 15 items in this scale were averaged to assess characteristic mindfulness of participants. The MAAS has demonstrated reliability, construct validity, convergent and discriminant validity ($\alpha = 0.89$; Brown & Ryan, 2003; Carlson & Brown, 2005; Osman, Lamis, Bagge, Freedenthal, & Barnes, 2016)

Momentary Measures

Momentary measures of affect, alcohol craving, distress tolerance, and mindfulness were administered to participants at time points depicted in Figure 1.

Affect Grid. The Affect Grid (Russel, Weiss, & Mendelsohn, 1989) is a single-item scale that measures affect on two-dimensions: pleasure-displeasure and arousal-sleepiness. The range of scores for each dimension is 1–9; lower values in the pleasure-displeasure dimension indicate displeasure and higher values indicate more pleasure; lower values in the arousal-sleepiness scale indicate lower arousal and higher values indicate higher arousal. The Affect Grid was used to measure changes in affect valence from pre- to post-mood induction using the pleasure-displeasure scores; a minimum of a one-point reduction in the pleasure-displeasure dimension score was used to indicate a successful mood-induction (Becker, Fischer, Smith & Miller, 2016; VanderVeen et al., 2016). Additionally, an Affect Grid was administered after the taste task to see if the effect of the mood-induction persisted, and at the end of the procedures to ensure that there was no residual distress. This measure has shown good reliability, discriminant validity, and convergent validity (Kilgore, 1998; Russel, Weiss, & Mendelsohn, 1989).

Alcohol Craving Questionnaire – Short Form – Revised. The Alcohol Craving Questionnaire – Short Form – Revised (ACQ-SF-R; Singleton, 1997) is a 12-item questionnaire assessing current craving for alcohol. This scale was adapted from the 47-item Alcohol Craving Questionnaire (ASQ-NOW; Singleton, Tiffany, & Henningfield, 2000). The ASQ-SF-R has four

subscales, each with three items: 1) compulsivity (e.g., "I could *not* stop myself from drinking if I had some alcohol here"); 2) expectancy (e.g., "Drinking would put me in a better mood"); 3) purposefulness (these items are reverse coded; e.g., "I'm *not* making any plans to drink."); and 4) emotionality (e.g., "I would feel less restless if I drank alcohol"). This full measure was administered before the negative mood-induction task. After the mood induction task, only the expectancy and emotionality subscales were administered. These select subscales of the ASQ-SF-R are used here in an effort to capitalize on the effects of the mood induction, which studies have shown to be brief in duration (Lench, Flores, & Bench, 2011; Westermann, Spies, Stahl, & Hesse, 1996; VanderVeen et al., 2016; Zhang et al., 2014). Only the select subscales described were used to analyze changes in pre- to post-mood induction craving. To assess craving, the average of the expectancy and emotionality scales were used, with higher scores indicating higher levels of alcohol craving. The ACQ-SF-R has shown good reliability and validity (α = 0.70; Singleton, Tiffany, & Henningfield, 1995).

Momentary Distress Intolerance Scale. The Momentary Distress Intolerance Scale (MDIS; Veilleux, Hill, Skinner, Pollert, Baker, & Spero, 2018) is a brief three-item momentary measure of emotional distress intolerance (e.g. "Right now, my emotions are getting in my way") on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). The average of all scale items (item 3 is reverse scored) was used to assess momentary distress intolerance after the negative mood induction, with higher average scores indicating lower distress tolerance. This scale demonstrated reliability and convergent and discriminant validity (α = 0.64; Veilleux et al., 2018).

The State Mindfulness Scale. The State Mindfulness Scale (SMS; Tanay & Bernstein, 2013) is a 21-item scale that measures present mindfulness based on attention and awareness of

current experiences (e.g. “I was aware of what was going on in my mind”, “I felt that I was experiencing the present moment fully”), using a scale from 1 (*not at all*) to 5 (*very well*). The average of all scores from the SMS was used to measure state mindfulness after the alcohol taste-task. This scale has demonstrated reliability, convergent and discriminant validity, construct validity, and criterion validity ($\alpha = 0.90$; Paz, Zvielli, Goldstein, & Bernstein 2017; Tanay & Bernstein, 2013).

Procedure

The procedures of this study took place in the context of a larger ABI-funded study investigating how impulsivity and negative mood influence drinking behavior. As part of the screening for the larger study, only participants with upper and lower quartiles of the four-item negative urgency subscale scores on the Short-form version of the Urgency, Premeditation (lack of), Perseverance (lack of), Sensation Seeking, Positive Urgency (UPPS-P) Impulsive Behavior Scale (SUPPS-P; Cyders, Littlefield, Coffey, & Karyadi, 2014; Lynam, 2013) were recruited for the study. In order to ensure accurate effects of the mood induction task and drinking task and to eliminate possible expectancy effects, deception was used in this study. The negative mood induction was described as a music and memory task. Participants were told that they would be randomly assigned to receive either caffeine or alcohol for a taste perception task; however, all participants were given an alcohol taste task, meant to measure alcohol consumption. After completion of the study, all participants were asked a series of questions to assess success of the deception and given a statement of debriefing explaining the deception and reason for using it.

Potential participants completed a phone screening prior to participation. The phone screen was used to exclude individuals who do not fall in the study participant age-range, who were currently abstaining or trying to abstain from alcohol, and who had not consumed alcohol

in the past 30 days. Additionally, individuals who reported use of nicotine products and did not want to abstain from use for the 2-hour duration of the study, were not be allowed to participate. The phone screen was also used to screen individuals for negative urgency using the SUPPS-P. Individuals were invited to participate in the study if their SUPPS-P total scores fall in the upper ($\geq$ 11) and lower quartiles ($\leq$ 7). If participants met the pre-screening requirements, they were scheduled for a 2-hour study visit in the laboratory beginning at 3pm or later in an effort to reduce variability in drinking behavior based on time of day (Liang & Chikritzhs, 2015).

All study procedures took place during one session. After explaining study procedures and obtaining proper informed consent, a trained graduate-level research assistant administered the screening assessments (MINI modules, AUDIT, and medical screening). Because participants consumed alcohol in this study, female participants were required to take a pregnancy test. Breath alcohol content (BrAC) was also measured using an Intoximeter FST® breathalyzer, to ensure that participants had not been drinking prior to participation. Participants who were deemed ineligible based on the screening assessments were compensated with a $5.00 gift card. Eligible participants completed background self-report measures on Qualtrics (i.e., demographics, DTS, MAAS, ACQ-SF-R, and other self-report questionnaires as part of the larger study) before the mood induction and other study procedures.

Mood Induction

After completing background measures, participants completed an Affect Grid to establish baseline affect. Participants then began the negative mood induction. The negative mood induction was introduced as a memory and music perception task; all participants were given a prompt to write about a distressing event that put them in a "bad mood." They were asked to write about this experience for 10 minutes, while listening to a classical music piece

(the first movement of Beethoven's Sonata No.14). This technique of eliciting negative affective states, labeled the Music and Contemplation in Idiographic context, has shown good reliability and validity (MCI; Lench, et al., 2011; Westermann et al., 1996; VanderVeen et al., 2016; Zhang et al., 2014). After completing the mood induction, participants completed another Affect Grid, MDIS, ACQ-SF-R (expectancy and emotionality subscales only), and a few brief measures (e.g., alcohol-related cognitions) as part of the larger study, before beginning the taste task.

Alcohol Taste Test Task

During the taste test task participants were given two beers, each containing a mixture of six ounces of non-alcoholic beer and six ounces of 5% alcohol by volume beer. This mix was developed in previous research to test drinking behavior in a way that balances safety (i.e., a lower BrAC due to lower alcohol by volume) and realism and believability of the beer (Fugitt & Ham, 2018). Graduate-student researchers brought the beers out to participants in clear pint-glasses labeled as "Beer A" and "Beer B," then explained the instructions for the taste test task. Participants drank ad-libitum while completing a survey in which they compared the beers on taste, smell, appearance, and palatability. In this survey participants were also asked about general beer liking on a 1 ("Completely Dislike") to 10 ("Completely Like") scale. The primary measure of alcohol consumption was the total amount of beer that the participant drank during this 10-minute taste task. This taste test method of ad-libitum alcohol consumption has shown good reliability and construct validity (Jones et al., 2015) and has been successfully utilized in our laboratory (Fugitt & Ham, 2018). After the taste task, participants completed an Affect Grid, SMS, and other brief alcohol-related cognition measures as part of the larger study.

Post-experimental Tasks

The participants watched a pleasant film clip from *When Harry Met Sally* to reduce residual distress from the mood induction (Erisman & Roemer, 2010; Gross & Levenson, 1995). A final Affect Grid was then given to ensure that the participant had no residual distress from the negative mood induction.

A debriefing session took place at the close of the experiment. Participants were asked a series of questions to determine the validity of the deceptions used in the mood induction and taste test task. Both deceptions were successful with all participants included in analyses. Participants were then given information about the study and justification for the use of deception and allowed participants to ask any questions they might have. Additionally, researchers were prepared to assess and address any residual negative effects from the negative mood induction; however, there were no participants for whom this was necessary. BrAC was measured again before the participant left as a safety precaution, consistent with the National Advisory Council on Alcohol Abuse and Alcoholism recommendations (NIAAA, 2005). No study participants' BrAC was above 0.04% (the safety threshold used in our lab) at the end of the study. Participants were compensated with a $25.00 gift card for their time and participation.

Results

Data Cleaning

All statistical analyses were completed using RStudio (R version 3.5.1; R Core Team, 2018). One participant did not complete the MDIS or MAAS; this participant was removed from analyses that used data from these measures. Missing values were identified for items on the SMS (n = 3) and MAAS (n = 1); these missing values were replaced with imputed values estimated from other measures using regression analyses (MAAS and DTS for SMS imputation;

SMS and DTS for MAAS imputation). Presented analyses use imputed data for these missing values.

Case analyses were performed for each model prior to model analyses to identify data points that are highly influential using Cook's distance values, leverage, and studentized residuals to identify outliers. For models with potentially problematic data points, model analyses were first run with all data included and then with them removed. For all analyses with highly influential and potentially problematic data points, removing these cases did not change the results of the analyses; therefore, all reported results are presented without cases removed.

Evaluation of assumptions of normality of residuals, linearity, and homogeneity of variance were performed for each linear model prior to analysis. Most models met the assumptions of normality and linearity; Hypothesis 1b (described below) did not meet the assumption of homogeneity of variance. The predictor variable (MDIS) for this analysis was log-transformed in an attempt to address this problem. This transformation did not have an effect on the model assumptions, nor did it change the results of this analysis. The results presented are from the analyses performed with un-transformed data. Outcomes of this analysis are interpreted with caution and further discussion is presented with the results of these analyses.

Evaluation of model assumptions also revealed that the alcohol consumption variable was significantly skewed. In order to address this issue, this variable was log-transformed. Models using the log-transformed alcohol consumption variable met all model assumptions; therefore, all results presented from models including alcohol consumption as an outcome variable, utilize log-transformed alcohol consumption.

Preliminary Analyses

A manipulation check of the change in affect valence from pre- (M = 6.38, SD = 1.37) to post- (M = 4.68, SD = 1.79) negative mood induction using a paired-sample t-test, demonstrated a significant change in affect, $t(70) = 8.44$, $p < 0.001$. Most participants indicated a decrease in affect valence from pre- to post-mood induction (N = 41), although several indicated no change in affect valence (N = 15) or an increase in affect valence (N = 15). Participants that had no change or a positive change in affect valence were not excluded from the analyses. Post-hoc analyses excluding individuals with no change or a positive change in affect valence did not yield a change in the outcomes of analyses.

A comparison of alcohol craving at pre- (M = 3.11, SD = 1.11) and post- (M = 3.28, SD = 1.32) negative mood induction was performed using a paired-sample t-test. Although there was an overall increase in craving, as predicted, this change was not significant, $t(70) = -1.81$, $p = 0.07$. As was proposed in the a priori data analytic plan, a craving change score was calculated by subtracting post- from the pre-mood induction craving score, using the abbreviated version of the ACQ-SF-R. Participants that had no change or a decrease in craving were not excluded from the analyses.

Table 2 displays correlations among study variables, affect valence ratings, beer liking ratings, and AUDIT scores. Mindfulness measures (SMS and MAAS) were positively correlated, and distress tolerance measures (DTS and MDIS) were negatively correlated with one another. Alcohol craving was negatively correlated with DTS but not with MDIS; furthermore, craving was not correlated with mindfulness measures. As might be expected, alcohol craving was positively related to AUDIT scores and beer liking ratings. Amount of beer consumed was unrelated to other variables except for reported beer liking. The mindfulness measures were both

negatively associated with AUDIT scores, as was DTS. DTS was positively related to both mindfulness measures, but MDIS was not.

Hypothesis-driven Analyses

Hypothesis 1: DT Predicting Alcohol Craving Change

A series of regression analyses were performed using the general linear model. Linear regression analyses with mean-centered DTS total score (general DT; Hypothesis 1a) and mean-centered MIDS total score (momentary DI; Hypothesis 1b) as predictors of change in pre- to post-mood induction alcohol craving were performed. Results indicated that MDIS significantly predicted craving change, $F(68) = 7.982$, $p < 0.001$, $\eta p^2 = 0.11$; however, DTS was not predictive of craving change, $F(69) = 0.060$, $p = 0.80$, $\eta p^2 < 0.001$. It should be noted that the model assumption of homogeneity of variance was violated for this model, likely due to floor effects of the MDIS in this sample. A secondary analysis using log-transformed MDIS did not fix the assumption violation, nor did it change the outcome of the analysis. Additionally, an effect size estimation based on the sample size ($N = 70$), power of 0.80, and alpha of 0.05 revealed that an effect size of $\eta p^2 = 0.23$, at least, would be needed to assume a meaningful result. Nevertheless, the data suggest that lower MDIS scores are related to an increase in craving from pre- to post- mood induction.

Hypothesis 2: DT Predicting Alcohol Consumption

Linear regression analyses with mean-centered DTS total score (general DT; Hypothesis 2a) and mean-centered MIDS total score (momentary DI; Hypothesis 2b) as predictors of amount of alcohol consumed (using the log-transformed alcohol consumption variable). Results indicated that DTS was not significantly predictive of alcohol consumption, $F(69) = 3.45$, $p = 0.07$, $\eta p^2 = 0.05$, nor was MDIS, $F(68) = 1.51$, $p = 0.22$, $\eta p^2 = 0.02$.

Hypothesis 3: DT and Mindfulness Predicting Alcohol Consumption

For my secondary analyses, I used multiple linear regressions to analyze the moderation effects of mindfulness on the relationship between distress tolerance and alcohol outcomes. To test the moderation effects of momentary mindfulness, I performed multiple linear regressions with mean-centered DTS total score (Hypothesis 3a) and mean-centered MDIS total score (Hypothesis 3b), mean-centered SMS total score (momentary mindfulness), and the interaction variable (moderation effect) as predictors of alcohol consumption (using log-transformed amount of alcohol consumption variable). Two observations were identified as being highly influential in the model for Hypothesis 3a; however, removing these observations did not change the results of the analysis and were therefore retained for the presented results. Results of these regression analyses are summarized in Table 3. There was no significant main effect of DTS or SMS on alcohol consumption, nor was the interaction of DTS and SMS significantly predictive of alcohol consumption, $F(63) = 0.41$, $p = 0.53$, $\eta p^2 = 0.01$. Additionally, the analysis of Hypothesis 3b revealed no significant main effect of MDIS or SMS on alcohol consumption, nor was the interaction of MDIS and SMS significantly predictive of alcohol consumption, $F(63) = 2.18$, $p = 0.15$, $\eta p^2 = 0.03$.

Hypothesis 4: DT and Mindfulness Predicting Alcohol Craving Change

To test the moderation effects of trait mindfulness, I performed multiple linear regressions with mean-centered DTS total score (Hypothesis 4a) and mean-centered MDIS total score (Hypothesis 4b), mean-centered MAAS total score (trait mindfulness), and the interaction variable (moderation effect) as predictors of alcohol consumption. Results of these regression analyses are summarized in Table 4. There was no significant main effect of DTS or MAAS on alcohol consumption, nor was the interaction of DTS and MAAS significantly predictive of

alcohol consumption, $F(65) = 0.54$, $p = 0.46$, $\eta p^2 = 0.01$. An observation was identified as being highly influential in the model for Hypothesis 4b; however, removing this observation did not change the results of the analysis and was therefore left in for the presented results. The analysis of Hypothesis 4b revealed no significant main effect of MDIS or MAAS on alcohol consumption, nor was the interaction of MDIS and MAAS significantly predictive of alcohol consumption, $F(65) = 0.013$, $p = 0.91$, $\eta p^2 < 0.001$.

Discussion

Previous research has found that distress tolerance (DT) is a predictor of alcohol-related problems and may be an important factor in the development of alcohol use disorder (AUD; Leyro et al., 2010). Additionally, DT has been associated with drinking motives to cope with negative affect (Khan et al., 2018; Wahesh, Moreton, & McKenchnie, 2020). This study was the first to date to explore the relationship between DT and (1) alcohol craving and (2) real-time alcohol consumption in response to an induced negative mood state. Uniquely, this study examined both trait DT and momentary distress intolerance (DI). Furthermore, this study explored how mindful awareness moderates these relationships, based on prior research demonstrating that mindfulness-based interventions for treating alcohol use may improve DT (Hsu, Collins, & Marlatt, 2013) and smoking cessation studies have found improvements when targeting DT using mindfulness strategies (Brown et al., 2018; Otto et al., 2020). It was hypothesized that trait DT would be negatively associated with alcohol craving change and alcohol consumption and that momentary DI would be positively associated with alcohol craving change and alcohol consumption post-mood induction. Trait and momentary mindfulness were hypothesized to interact with these relationships, such that individuals with greater mindful

awareness would demonstrate a stronger association between DT and alcohol craving and consumption.

The hypothesis that DT is predictive of alcohol craving change was partially supported. Specifically, momentary DI was predictive of alcohol craving change, but trait DT was not. This lack of association between trait DT and alcohol craving change is surprising considering extant literature has found that lower trait DT is associated with increased craving of cigarettes (Matthew et al., 2018; Trujillo et al, 2017) and one study has found an association between higher trait DT and lower alcohol and drug craving in an inpatient setting (Shorey et al., 2017). Importantly, these studies did not examine craving related to affect or distress; therefore, it is important to consider that trait DT may not be a strong predictor of craving changes in response to a change in affect. This is the first study to-date to evaluate the relationship between momentary DI and alcohol craving. The results of this study suggest that momentary DI may be a more robust predictor of alcohol craving than trait DT. These results should be interpreted with caution, however, due to the small sample and low effect size, as well as violation of homogeneity of variance in this model (see Results).

Furthermore, trait DT and momentary DI were not significantly predictive of alcohol consumption in this study. It may be important to consider the relationship between trait DT as it relates to in-the-moment behavior. Prior research has demonstrated a weak relationship between self-reported trait DT and behavioral measures of DT (Ameral et al., 2014; Buckheit, De Vita, & Maisto, 2020; McHugh & Otto, 2011). This is likely because self-report measures assess perceived ability to withstand distress, whereas behavioral measures assess perseverance in a distressing task (Veilleux, 2019). I hypothesized that individuals with lower levels of DT would consume more alcohol to ameliorate distress from the mood induction task. It is possible that

self-report DT (perceived ability to withstand distress) may not be predictive of alcohol consumption and perhaps behavioral measures of DT would be better predictors of drinking behavior. For example, one study found that behavioral DT significantly predicted heavy episodic drinking in college age students (Perdelli et al., 2018). More research is needed to understand how these potentially distinct DT constructs may differentially relate to in-the-moment drinking behavior, as well as alcohol craving.

Previous research has demonstrated that drinking context may affect alcohol expectancies, or beliefs one holds about the effects of drinking, and drinking behavior (Ham et al., 2012; Wolkowicz et al., 2019). Alcohol expectancies, which were not looked at directly in this study, are beliefs about the possible positive or negative effects of drinking alcohol; these have been found to vary across drinking contexts and may influence drinking behavior (Wolkowicz et al., 2019). Importantly, these studies examining context-specific drinking behavior focus on real-world drinking contexts, not a laboratory setting. Drinking in a laboratory setting could likely differ from real-world drinking behavior. Additionally, by design, individuals participating in this study were not heavy drinkers; therefore, it is possible that individuals in this study are not likely to engage in drinking to cope with negative affect, no matter the drinking context. Because drinking and craving are therefore likely to be low in this context and is reportedly low with this sample in general, it is understandable that the results would not show a difference in these outcomes based on varying reported levels of DT.

A strength of this study was the use of multiple predictors and methods of measuring each variable. By measuring both trait DT and momentary DI, I was able to evaluate two unique aspects of DT: overall perceived capacity to withstand negative affective states and in-the-moment perception of this ability. Importantly, this study also evaluated alcohol craving, a

predictor of in-the-moment drinking (Pombo et al., 2016), and ad libitum alcohol consumption, which evaluate two unique aspects of drinking behavior. Finally, two mindfulness measures were used to evaluate trait mindful awareness and use of mindful awareness in the moment, during the drinking task. Although results of analyses investigating these variables were nonsignificant, the use of multiple measures strengthens confidence in the results of this study.

Limitations and Future Directions

It may be important to consider the role of alcohol taste preference in the alcohol consumption task. All participants were given beers in this study, but 30.99% of participants indicated liking beer less than "Neutral." Due to limited sample size, these individuals were included in all analyses. For those individuals who do not like beer, this may have affected the amount of beer consumed during the taste test task; this is evidenced by the positive correlation between beer liking and alcohol amount consumed seen in Table 2. Future research should consider screening individuals based on alcohol preference or providing more than one drink option to reduce the effect of preference on quantity of consumption.

An additional limitation to this study was that participants' typical alcohol use was very low overall. Mean AUDIT score in this sample was 4.92 (*SD* = 3.45), whereas the cutoff score for hazardous drinking is an 8 on the AUDIT. Although this is beneficial for decreasing potential risk and harm to participants consuming alcohol in the lab, these individuals may not have been representative of individuals for whom alcohol craving and drinking to cope is relevant. AUDIT scores were highly correlated with pre-mood craving scores and post-mood craving scores, suggesting individuals with higher AUDIT scores were more likely to endorse alcohol craving. However, it is important to note that craving scores were low pre-mood induction and there was not a significant increase in craving at post-mood induction. Future studies might exclude

individuals scoring very low on the AUDIT or individuals who do not consume alcohol on a frequent basis. It is also important to note that AUDIT scores were not correlated with alcohol consumption in this study, suggesting that this might not be a good predictor of potential hazardous drinking behavior and AUD specifically; this is consistent with previous findings (Jones et al., 2016).

Furthermore, the predictions of the current study assume that individuals in this study with low DT were more likely to use alcohol due to coping motives to drink (Khan et al., 2018; Wahesh, Moreton, & McKenchnie, 2020); however, this study did not examine the role of drinking motives in alcohol craving or consumption. One study found that trait DT was related to coping motives to drink but did not predict alcohol use problems (Howell et al., 2010). However, this study found that discomfort intolerance and anxiety sensitivity were significantly predictive of alcohol use problems; it is possible that these similar but distinct concepts may better account for the association often predicted between trait DT and alcohol use. This contradicts other literature demonstrating a relationship between DT and alcohol use (Leyro et al., 2010; Simons et al., 2018). Additional research exploring the relationship between trait DT and momentary DT as it relates to craving and alcohol use is needed to better understand how these important concepts relate.

Another limitation of this study was that the mood induction was only effective in about 60% of participants included in this study. The mood induction task used in this study was 10 minutes long, which may have been too long to induce the desired negative change in affect valence. Studies have found that writing about negative events can actually lead to significant improvements in mood (Marlo & Wagner, 1997; Pennebaker, 1997). This may explain why many of the participants in this study had an increase in affect valence after the negative mood

task. Furthermore, negative mood induction effects have been found to be brief (Lench, Flores, & Bench, 2011; Westermann, Spies, Stahl, & Hesse, 1996; VanderVeen et al., 2016; Zhang et al., 2014); although this study was designed to capitalize on the brief effect of mood induction used, it is possible that the affect valence effects were not sustained long enough to result in a change in craving or increased desire to consume alcohol. Removing individuals for whom the mood induction was not effective did not significantly change the results of the analyses presented; however, it did strengthen the effect and significance of the finding that momentary distress intolerance is predictive of change in craving. In a larger sample, removing participants without a significant decrease in affect valence may result in more robust findings. Additionally, future studies may consider using an abbreviated mood induction task or utilizing other methods of inducing negative mood, which might be sustained for longer.

It is important to note that mindfulness measures used in this study focused primarily on the awareness aspect of mindfulness and did not assess for utilization of mindfulness skills such as non-judgement and acceptance (Bishop et al., 2004). One study found that mindful awareness was predictive of higher levels of persistence on a behavioral task measuring DT (Feldman et al., 2014); however, it is important to consider that mindful awareness and tolerance of emotional distress, as DT is defined in this study, may have a different relationship. Additionally, a study examining the relationship between mindfulness skills and distress tolerance in smokers found that greater use of 'acting with awareness' and 'accepting without judgement' were associated with greater DT (Luberto et al., 2014). It may be the case that the acceptance aspect of mindfulness is more strongly associated with differences in DT and may have a stronger effect on drinking behaviors than mindful awareness. Future research should include measures that

better capture the acceptance aspect of mindfulness, which may be a more important treatment target for individuals with low DT and increased risk for alcohol use. (Bishop et al., 2004)

This study was part of a larger study looking at the difference in responding for individuals endorsing high versus low trait-level negative urgency (NU). NU is defined as the tendency to engage in impulsive behaviors when experiencing distress (Cyders & Smith, 2007) and it has been associated drinking behavior (Anthenien, Lembo, & Neighbors, 2017; Smith & Cyders, 2016). This may have affected the results of this study as NU, and impulsivity more broadly, overlaps with the concepts researched in this study. One study found that when including variables of DT, NU, and neuroticism, NU predicted alcohol use problems above and beyond the other two factors (Kaiser et al., 2012). Another study found that DT mediated the relationship between impulsivity and alcohol use coping motives (Marshall-Berenz, Vujanovic, & MacPherson, 2011). Inclusion of only high and low NU individuals may have confounded the findings of this study. Furthermore, due to difficulties with recruitment, fewer individuals high in NU than individuals low in NU were recruited for this study. In the larger study, high NU individuals are hypothesized to be more likely to engage in drinking behaviors and to endorse coping motives to drink. Including primarily low NU individuals in this study may have been related to the low alcohol consumption, low overall craving, and low AUDIT scores seen in participants in this study. Future studies should control for this variable or remove this eligibility criterion.

Finally, the sample included in this study was smaller than the projected sample needed to detect an effect. An *a-priori* statistical power analysis was conducted using an effect size of $r = 0.31$, based on prior cross-sectional research looking at the association between distress tolerance and alcohol craving (Shorey et al., 2017). With power of 0.80 and alpha of 0.05, a

projected sample size of 79 was needed to detect an effect in the general linear model. Unfortunately, due to recruitment challenges, the desired sample size was not achieved. The low sample size may account for the insignificant findings in this study and low effect size in the significant finding predicting alcohol craving change from MDIS. Future research should include a larger sample to re-assess the findings of this study.

Conclusions

The present study is novel in the examination of the relationship between DT and alcohol craving and real-time alcohol consumption; furthermore, it is the first known study to look at momentary DI, specifically, in the context of alcohol use. Contrary to previous empirical work and theoretical constructs, trait DT was not predictive of alcohol craving nor was it predictive of alcohol consumption; however, momentary DI was predictive of alcohol craving change, indicating that this may be an important predictor of alcohol use to study in future research. Furthermore, despite extant literature exploring the relationship between mindfulness, DT, and alcohol use, mindfulness did not moderate relationships between measure of DT and alcohol craving or consumption. Using measures of mindfulness that capture acceptance and non-judgment may be important to better understanding how mindfulness relates to these other concepts. Additional research is needed to determine the role of trait and momentary mindfulness skills in alcohol use, specifically related to perceived ability to withstand distressful emotions (DT). Further research evaluating these constructs is needed before conclusions are made regarding these relationships; however, results of this study suggest that momentary DI may be a better predictor of alcohol craving change after a negative mood induction than trait DT. Thus, momentary DI may be an important treatment target in treatment of alcohol use.

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Figures and Tables

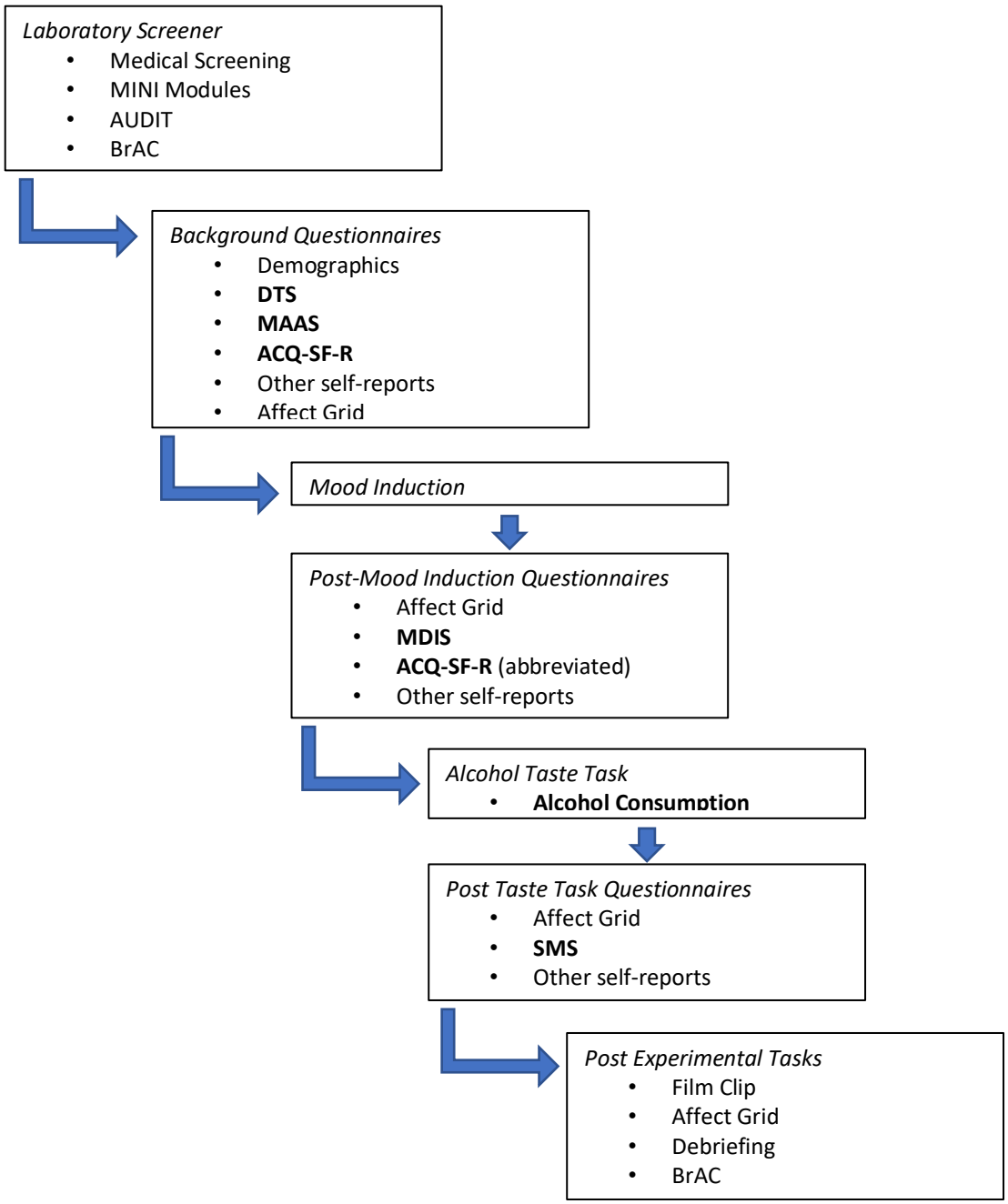

Figure 1. *Layout of procedures*. Outcome measures are bolded. AUDIT = Alcohol Use Disorder Identification Test; BrAC = breath alcohol content; DTS = Distress Tolerance Scale; MAAS = Mindful Awareness and Attention Scale; ACQ-SF-R = Alcohol Craving Questionnaire Short Form Revised; MDIS = Momentary Distress Intolerance Scale; SMS = average score on the State Mindfulness Scale.

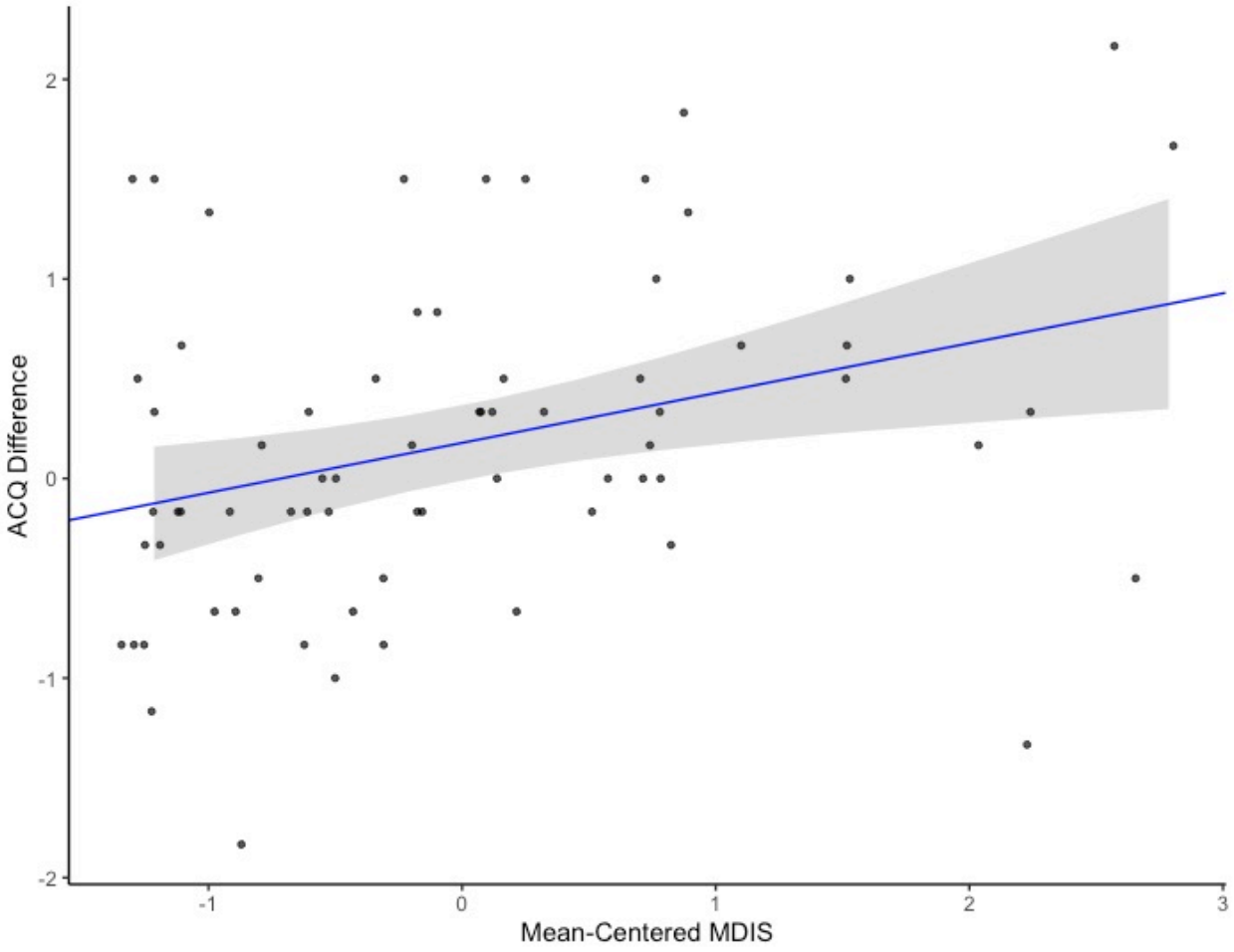

Figure 2. *Momentary Distress Intolerance Predicts Craving Change.* ACQ Difference, on the Y-axis, represents the change in Alcohol Craving Questionnaire Short Form Revised average score from pre- to post-mood induction. The mean-centered Momentary Distress Intolerance Scale (MDIS) scores are represented on the X-axis. Overall, MDIS predicted change in craving, as measured by ACQ difference scores, $F(68) = 7.982$, $p < 0.001$, $\eta p^2 = 0.11$.

Table 1. *Sample Demographics.*

Variable	*N*	*%*	*M*	*SD*
Age	71		24.53	3.56
Biological Sex				
Male	28	39.44%		
Female	43	60.56%		
Gender				
Male	28	39.44%		
Female	42	59.15%		
Other	1	1.41%		
Ethnicity				
White (non-Hispanic)	56	78.87%		
Hispanic/Latino	6	8.45%		
Black/African American	2	2.81%		
American Indian	2	2.81%		
More than one	3	4.23%		
Sexual Orientation				
Heterosexual	59	83.09%		
Homosexual	4	5.63%		
Bisexual	6	8.45%		
Asexual	2	2.81%		
Marital Status				
Single	61	85.92%		
Married	10	14.08%		
Employment Status				
Employed 1-20 hours/week	30	42.25%		
Employed 20-30 hours/week	10	14.08%		
Employed Full-time	19	26.76%		
Unemployed	12	16.90%		

Note. M and *SD* are used to represent mean and standard deviation, respectively, and *N* is used to represent the total participants per demographic.

Table 2. *Means, standard deviations, and correlations with confidence intervals.*

Variable M (*SD*)	1	2	3	4	5	6	7	8	9	10
1. Beer Liking 6.17 (*2.55)*										
2. AUDIT 4.92 (*3.45*)	.16 [-.08, .38]									
3. AlcAmount 219.56 (*153.13*)	.38** [.16, .56]	.04 [-.20, .27]								
4. ACQ-Pre 3.11 (*1.11*)	.32** [.09, .51]	.40** [.18, .58]	.09 [-.14, .32]							
5. ACQ-Post 3.28 (*1.32*)	.32** [.09, .51]	.30* [.07, .50]	.06 [-.17, .29]	.79** [.68, .86]						
6. AGV-Pre 6.58 (*1.37*)	.11 [-.13, .34]	-.19 [-.40, .05]	-.07 [-.29, .17]	-.12 [-.34, .12]	-.04 [-.27, .19]					
7. AGV-Post 4.68 (*1.79*)	.01 [-.22, .24]	-.20 [-.42, .03]	.09 [-.15, .32]	.13 [-.11, .35]	-.01 [-.24, .23]	.30* [.07, .50]				
8. DTS 3.87 (*0.77*)	.15 [-.08, .37]	-.36** [-.55, -.14]	.08 [-.15, .31]	-.27* [-.47, -.04]	-.24* [-.45, -.01]	.25* [.02, .45]	.07 [-.16, .30]			
9. MDIS 2.21 (*1.07*)	-.18 [-.39, .06]	.21 [-.03, .42]	-.01 [-.25, .22]	-.05 [-.28, .19]	.16 [-.08, .38]	-.19 [-.41, .05]	-.24* [-.45, -.01]	-.33** [-.52, -.10]		
10. SMS 3.50 (*0.68*)	.09 [-.16, .32]	-.29* [-.49, -.05]	-.09 [-.33, .15]	-.07 [-.30, .18]	.04 [-.21, .27]	.26* [.02, .47]	-.04 [-.28, .20]	.43** [.22, .61]	-.01 [-.25, .23]	
11. MAAS 4.12 (*0.79*)	.04 [-.20, .27]	-.24* [-.45, -.00]	.08 [-.16, .30]	-.17 [-.39, .07]	-.08 [-.31, .16]	.19 [-.04, .41]	.12 [-.12, .34]	.49** [.29, .65]	-.04 [-.28, .20]	.44** [.23, .62]

Table 2 (Cont.) *Note.* M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$. Beer Liking = subjective rating of beer liking; AUDIT = total score on the Alcohol Use Disorder Identification Test; AlcAmount = total milliliters of alcohol consumed during taste task; ACQ-Pre = average score on Alcohol Craving Questionnaire Short Form Revised prior to mood-induction task; ACQ-Pre = average score on Alcohol Craving Questionnaire Short Form Revised after the mood-induction task; AGV-Pre = Affect Grid valence scale score prior to mood-induction task; AGV-Pre = Affect Grid valence scale score after the mood-induction task; DTS = average score on Distress Tolerance Scale; MDIS = average score on the Momentary Distress Intolerance Scale; SMS = average score on the State Mindfulness Scale; MAAS = average score on the Mindful Awareness and Attention Scale.

Table 3. *Multiple linear regression results using log-transformed alcohol consumption variable as the criterion*

	Predictor	*df*	Mean Square	*F*	*p*	$_{partial}\eta^2$	$_{partial}\eta^2$ 90% CI [LL, UL]
Hypothesis 3a	(Intercept)	2	57.40	93.03	.000		
	DTS	2	0.01	0.01	.925	.00	[.00, .01]
	SMS	2	0.60	0.98	.327	.02	[.00, .10]
	DTS x SMS	2	0.25	0.41	.526	.01	[.00, .07]
	Error	63	0.62				
Hypothesis 3b	(Intercept)	2	65.37	102.89	.000		
	MDIS	2	0.91	1.43	.236	.02	[.00, .11]
	SMS	2	0.06	0.10	.751	.00	[.00, .05]
	MDS x SMS	2	1.38	2.18	.145	.03	[.00, .13]
	Error	63	0.64				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively. DTS = average score on Distress Tolerance Scale; MDIS = average score on the Momentary Distress Intolerance Scale; SMS = average score on the State Mindfulness Scale.

Table 4. *Multiple linear regression results using ACQ difference score as the criterion.*

	Predictor	*df*	Mean Square	*F*	*p*	$_{partial}\eta^2$	$_{partial}\eta^2$ 90% CI [LL, UL]
Hypothesis 4a	(Intercept)	2	0.39	0.56	.459		
	DTS	2	0.22	0.32	.576	.00	[.00, .07]
	MAAS	2	0.87	1.24	.269	.02	[.00, .10]
	DTS x MAAS	2	0.38	0.54	.465	.01	[.00, .08]
	Error	65	0.70				
Hypothesis 4b	(Intercept)	2	0.21	0.33	.565		
	MDIS	2	0.12	0.19	.661	.00	[.00, .06]
	MAAS	2	0.57	0.90	.346	.01	[.00, .09]
	MDIS x MAAS	2	0.01	0.01	.909	.00	[.00, .01]
	Error	65	0.63				

Note. LL and UL represent the lower-limit and upper-limit of the partial η^2 confidence interval, respectively. DTS = average score on Distress Tolerance Scale; MDIS = average score on the Momentary Distress Intolerance Scale; MAAS = average score on the Mindful Awareness and Attention Scale.