The Role of Distress Tolerance in the Relationship between Depressive Symptoms and Problematic Alcohol Use

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Abstract

Empirical evidence and theory implicate the role of distress tolerance in the relationship between negative affect and alcohol use. However, limited research has been conducted exploring these relationships. As such, the purpose of the current study was to examine whether distress tolerance moderates the relationship between current depressive symptoms and problematic alcohol use in a community sample of adults. Participants included 150 adults, primarily female, recruited from the local community. Problematic alcohol use was measured using the Alcohol Use Disorders Identification Test (AUDIT) total score which is a composite measure of harmful and hazardous patterns of alcohol use and several current alcohol dependence symptoms. Distress tolerance was measured using a computerized behavioral distress tolerance task, the *Computerized Paced Auditory Serial Addition Task (PASAT-C)*. Tobit regression analyses indicated a significant interaction between distress tolerance and depressive symptoms in predicting alcohol problems, such that depressive symptoms were significantly associated with problematic alcohol use among adults with low, but not high, distress tolerance. Thus, alcohol use interventions with a focus on distress tolerance skills in the context of depressive symptoms may be particularly effective.

Keywords

Alcohol Use; Distress Tolerance; Depressive Symptoms

Adult alcohol use, including heavy drinking and binge drinking, is the third leading lifestyle-related cause of death in the United States and is associated with numerous adverse behavioral and psychological consequences (Mokdad, Marks, Stroup, & Gerberding, 2004). More specifically, alcohol use is associated with co-occurring psychiatric symptoms (Chan, Dennis, & Funk, 2008; Burns & Teesson, 2002), increased rates of suicide (Wilcox, Connor, & Caine, 2004), and poor physical health outcomes (Centers for Disease Control and Prevention [CDC], 2004). As such, identifying the mechanisms underlying problematic alcohol use is critical for the development of effective interventions.

One theoretical approach that has been identified in the larger substance use literature is negative reinforcement. Negative reinforcement models posit that the motivational basis for substance use is the reduction or avoidance of negative affective states (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Eissenberg, 2004). Specifically, it is postulated that alcohol use in response to negative affect brings perceived and/or real relief, thereby reinforcing this behavior and increasing the likelihood of using alcohol in the future. Overtime, this reliance on alcohol use as a coping mechanism has been shown to increase the risk for alcohol abuse and dependence (Kassel, Jackson, & Unrod, 2000; Grunberg, Moore, Anderson-Connolly, & Greenberg, 1999). Thus, the reduction of negative affect is considered to be an important process underlying motivation to use alcohol and escalation to harmful patterns of alcohol use.

In line with negative reinforcement theory, a large body of evidence suggests that depressive symptoms are associated with alcohol use (Dixit & Crum, 2000; Holahan, Moos, Holahan, Cronkite, & Randall, 2001; Kodl et al., 2008; Greenfield et al., 1998; Abraham & Fava, 1999). More specifically, studies indicate that depression and alcohol use disorders frequency co-occur (Gratzer et al., 2004; Kessler et al., 1996) and that elevated depressive symptoms significantly increase the risk for heavy alcohol use (Dixit & Crum, 2000; Abraham & Fava, 1999). Further, depressive symptoms have been shown to significantly predict alcohol use relapse (Kodl et al., 2008; Greenfield et al., 1998) and reducing depressive symptoms significantly improves rates of abstinence following alcohol use treatment (Ramsey, Engler, & Stein, 2005; Brown & Ramsey, 2000). Taken together, evidence suggests that negative reinforcement processes may underlie the relationship between depressive symptoms and alcohol use.

One way to assess an individual's propensity to engage in behaviors motivated by negative reinforcement is to examine distress tolerance. Distress tolerance is defined in two different ways, depending on the mode of assessment. Behavioral measures of distress tolerance serve as a proxy for negative reinforcement behavior by assessing an individual's ability to persist in goal-directed behavior while experiencing affective distress. Self-report distress tolerance, on the other hand, takes the form of retrospective self-report measures and assesses an individual's perceived capacity to withstand aversive states (see Leyro, Zvolensky, & Bernstein, 2010 for a review). Distress tolerance is an important component of affect regulation and behavior, and studies indicate a statistically significant relationship between distress tolerance and substance use (Brandon et al., 2003; Daughters, Lejuez, Kahler, Strong, & Brown, 2005b). Specific to alcohol, it has been shown that self-reported distress tolerance is associated with alcohol related problems (Buckner, Keough, & Schmidt, 2007; Simons & Gaher, 2005), coping motives for alcohol use (Howell, Leyro, Hogan, Buckner, & Zvolensky, 2010), and a weaker relationship between positive affect and alcohol consumption (Simons, Gaher, Oliver, Bush, & Palmer, 2005). Only one study to date has utilized a behavioral measure to examine the relationship between distress tolerance and alcohol use, and reported that low distress tolerance was associated with an increased frequency of alcohol use among Caucasian early adolescents (Daughters et al., 2009).

Although empirical evidence and theory suggest that individual differences in distress tolerance may influence the relationship between depressive symptoms and alcohol use, there has been limited research examining these relationships. This omission is noteworthy given that it has been demonstrated that only a subset of individuals (e.g., men, those with positive expectancies for alcohol) are at risk for using alcohol in response to negative affect (Hussong, Hicks, Levy, & Curran, 2001; Cooper, Russell, Skinner, & Windle, 1992); suggesting that there may be important moderators influencing this association. One important exception is a study by Buckner et al. (2007) which found that self-reported distress tolerance mediated the relationship between depressive symptoms and alcohol

problems among a sample of undergraduates. Although this study highlights the importance of considering individual differences in distress tolerance, it is still unclear whether distress tolerance plays a role in the relationship between depressive symptoms and alcohol use among adults. Further, although self-report measures of distress tolerance have demonstrated good psychometric proprieties (Simons & Gaher, 2005), there is a need to explore these relationships using behavioral measures given the potential conceptual differences among these modalities (Leyro et al., 2010).

The aim of the current study was to examine whether current depressive symptoms and a behavioral measure of distress tolerance interact to predict problematic alcohol use in a community sample of adults. Specifically, the Alcohol Use Disorders Identification Test (AUDIT) was used to measure hazardous and harmful patterns of alcohol consumption and current alcohol dependence symptoms (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993b). In line with prior research, it was hypothesized that depressive symptoms would be significantly associated with problematic alcohol use, only among those with low distress tolerance.

Method

Participants

A total of 161 parental guardians (90.1% Biological Mother, $n = 145$) and their adolescent (ages 14 to 18) participated in a larger cross-sectional study examining the relationship between distress tolerance and adolescent behavior outcomes. However, given our aims, only the adult participants are included in the current study. Eleven participants were excluded from analyses due to incomplete self-report data. The final sample included 150 adults. Participant demographic characteristics are displayed in Table 1.

Procedure

Participants provided written informed consent and all aspects of the study were approved by the University Institutional Review Board. Following informed consent, participants completed a battery of self-report measures and a computerized behavioral distress tolerance task.

Distress Tolerance

The *Computerized Paced Auditory Serial Addition Task* (PASAT-C; Lejuez, Kahler, & Brown, 2003) was administered to assess distress tolerance. The PASAT-C has been shown to reliably increase participant distress levels and has repeatedly been used as a behavioral measure of distress tolerance (Daughters et al., 2005a; Daughters et al., 2009; Daughters, Sargeant, Bornovalova, Gratz, & Lejuez, 2008). In sum, participants are exposed to an increasingly difficult working memory task, accompanied by forced failure and negative auditory feedback. They are given the option to quit the task early on the last level (i.e., low distress tolerance) or to persist for the entire duration for an undefined reward (i.e., high distress tolerance). The reader is referred to Daughters et al. (2005a) for a detailed description of the task.

Assessment of Alcohol Use

The Alcohol Use Disorders Identification Test (AUDIT; Babor, De La Fuente, Saunders, & Grant, 1989). The World Health Organization (WHO) developed the AUDIT as a brief screening tool for hazardous and harmful alcohol use. The scale contains 10 questions in which responses are made using a 5-point Likert scale. The AUDIT total score is a composite index of hazardous and harmful alcohol use and alcohol dependence symptoms, and is defined as total problematic alcohol use. Sample items from the AUDIT include

"How often do you have a drink containing alcohol?" and "Have you or someone else been injured because of your drinking?" The AUDIT has been shown to be a sensitive assessment of harmful alcohol use in diverse populations and has demonstrated good internal consistency (Saunders, Aasland, Amundsen, & Grant, 1993a; Saunders et al., 1993b). Reliability of total scores within the current study was good (α = .74).

Depressive Symptoms

The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a widely used 20-item self-report measure of current depressive symptoms. Participants are asked to respond to each item using a 4-point Likert scale with 0 indicating that the symptoms were experienced "rarely or not at all" and 3 indicating that the symptoms were experienced "most or all of the time" during the past week. Total scores range from 0 to 60 and a cutoff point of 16 or above is frequently used to index current depression (Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977; Radloff, 1977). Sample items include "I felt sad" and "I had crying spells." The scale has been shown to have good internal consistency and construct validity (Radloff, 1977). Reliability in the current sample was good (α = .79).

Potential Covariates

Demographic information including age, gender, race, education, and annual household income were collected from each participant. In addition, given the association between impulsive behavior and alcohol use, we administered the impulsivity subscale of the *Eysenck Impulsiveness Scale* (EIS; Eysenck, Pearson, Easting, & Allsopp, 1985) in which participants are asked to respond yes/no to each item. Total scores range from 0 to 19 with higher scores indicating increased impulsivity. Reliability for the EIS in the current sample was good (α = .75).

Data Analysis Plan

Analyses were conducted with the AUDIT total score as the primary dependent variable given that it is a composite score of problematic alcohol use. Distress tolerance was dichotomized as participants that quit the PASAT-C prior to the end of the task (i.e., low distress tolerance) and participants that persisted for the entire duration (i.e., high distress tolerance). Baseline demographic variables and impulsivity were first examined for associations with problematic alcohol use. CES-D total score was mean centered prior to data analysis (Aiken & West, 1991). We then examined the unique and interactive effects of depressive symptoms and distress tolerance on problematic alcohol use using tobit regression analyses (Greene, 1997; Roncek, 1992). We chose to use tobit models because a large number of participants within the current study had an AUDIT score of zero and tobit regression allows for the appropriate analysis of censored data (Delva, Grogan-Kaylor, Steinhoff, Shin, & Siefert, 2007; Grogan-Kaylor & Otis, 2003). Tobit regression models were fit using the PROC QLIM procedure in SAS version 9.2 (SAS Institute Inc., 2008).

Results

Descriptive Data

Descriptive data for participant characteristics are provided in Table 1. The relationships among study measures are presented in Table 2. Additional one-way ANOVAs indicated no significant relationship between ethnicity and AUDIT total scores [$F(6,144) = 1.24$, $p > .05$].

Distress Tolerance

Participants persisted on the PASAT-C for an average of 367.2 seconds ($SD = 118.2$) and 21.3% ($n = 32$) quit the task before the 7 minutes expired. Paired t tests indicated that there was a significant increase in anxiety [$t(1, 148) = -6.7$, $p < .01$], frustration [$t(1, 148) = -8.4$, $p < .01$], irritability[$t(1, 148) = -5.3$, $p < .01$], physical discomfort [$t(1, 148) = -3.1$, $p < .01$], and difficulty concentrating [$t(1, 148) = -8.1$, $p < .01$] during the PASAT-C, indicating that the task induced distress. Skill on the PASAT-C was indexed by the number of correct responses during level 2 ($M = 14.45$, $SD = 7.69$). There was no relationship between the number of correct responses and distress tolerance [$F(31, 119) = 1.03$, $p > .05$].

Depressive Symptoms by Distress Tolerance Interaction

First, we examined whether demographic variables or impulsivity were significantly associated with AUDIT total scores. Given that current depressive symptoms (see Table 2) was the only variable associated with AUDIT total score, no covariates were included in subsequent analyses.

In line with the standard methods for tobit regression analyses (Greene, 1997), CES-D total score, distress tolerance, and the interaction term of these two variables were entered into the model. Results indicated that increased depressive symptoms were significantly associated with problematic alcohol use ($p = < 0.01$). However, the main effect for distress tolerance only approached significance ($p = 0.06$). Results did indicate a significant depressive symptoms by distress tolerance interaction ($p = 0.01$).

To follow-up the significant interaction, we examined the conditional effects of current depressive symptoms on problematic alcohol use at high versus low distress tolerance, using published guidelines to examine interactions between continuous and categorical variables (Aiken & West, 1991; Holmbeck, 2002). More specifically, we computed two new conditional moderators in which the zero point for each variable was manipulated to create group-specific equations (i.e., high and low distress tolerance) and subsequently created two new interaction terms using these conditional moderators. Afterwards, two post-hoc regressions were run incorporating the main effect of CES-D, the conditional moderator, and the interaction of the two variables. Among those with low distress tolerance, results indicated that increased depressive symptoms were significantly associated with increased problematic alcohol use ($p = .04$). However, among those with high distress tolerance, depressive symptoms were not significantly associated with problematic alcohol use ($p = .19$). Results from the tobit analyses are displayed in Table 3.

Discussion

Although extant research and theory implicate the role of distress tolerance in the relationship between negative affect and alcohol use, limited research has been conducted exploring these relationships. As such, the purpose of the current study was to examine whether distress tolerance moderates the relationship between current depressive symptoms and problematic alcohol use in a community sample of adults. As hypothesized, results from the current study indicated that depressive symptoms were associated with problematic alcohol use among adults with low, but not high, distress tolerance.

The results from the current study are in line with a large body of literature noting that individuals with higher levels of depressive symptoms are more likely to consume alcohol and experience alcohol related problems (Watts, 2008; Dixit & Crum, 2000; Wilsnack, Klassen, Schur, & Wilsnack, 1991). In addition, these findings extend previous work by highlighting the importance of one's ability to tolerate these aversive affective states. In direct support of the larger negative reinforcement and distress tolerance literature, our

findings suggest that individuals with elevated current depressive symptoms *and* an inability to tolerate these affective states may use alcohol to cope with their low mood. Subsequently, this reliance on alcohol as a coping mechanism may lead to harmful patterns of alcohol use and an increased risk for alcohol abuse and dependence (Kassel et al., 2000; Grunberg et al., 1999).

It is also important to note that within the current study, the main effect of distress tolerance on problematic alcohol use only approached significance ($p = .06$). Although there are several potential explanations for this trend, dichotomizing distress tolerance may have resulted in a loss of power and lowered our ability to detect true statistical differences (Maxwell & Delaney, 1993). Alternatively, as has been suggested by others (Simons & Gaher, 2005), it is possible that men with low distress tolerance are more likely to experience alcohol related problems. Thus, within our sample of primarily females, distress tolerance may not be directly associated with problematic alcohol use. While there may not be a direct relationship, our findings do suggest that among those with current depressive symptoms, individual differences in distress tolerance influence alcohol use.

Although these findings address important gaps within the literature, there are several limitations of note. First, as was previously discussed, our sample included primarily females and thus, our findings may not be generalizable to males. Given the mixed findings for men and women, future research is needed to clarify these relationships and explore gender specific factors underlying the association between distress tolerance and problematic alcohol use. In addition, the current sample reported relatively low levels of problematic alcohol use. Although appropriate statistical techniques were used to handle this type of data (Greene, 1997), future research would benefit by using either a clinical population or those with increased rates of problematic drinking. Moreover, the current design was cross-sectional and thus, we are unable to make inferences of causality. Therefore, the next step would be to utilize a longitudinal design in order to specify the direction of effects between distress tolerance, depressive symptoms, and the development of problematic alcohol use.

With these limitations in mind, there are important implications of these findings. First, among those with current depressive symptoms, individual differences in distress tolerance may serve as a risk factor for harmful patterns of alcohol use. Further, numerous studies have found distress tolerance to be an important factor in substance use behaviors and outcomes (Brown, Lejuez, Kahler, & Strong, 2002; Daughters et al. 2005a; Quinn, Brandon, & Copeland, 1996), which suggests that distress tolerance may serve as a common mechanism underlying the relationship between negative affect and a variety of substances of abuse. Therefore, treatments specifically designed to improve distress tolerance among substance users (Bornovalova, Gratz, Daughters, Hunt, & Lejuez, in press) may be important in establishing appropriate coping strategies to reduce negative affect and eliminate reliance on substance use behavior.

Acknowledgments

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Table 1

Participant Characteristics.

Variable	Final Sample (n = 150)
Age	46.1 (7.8)
Annual Income	86,300 (47,700)
Female	90.7%
Education	
Some High School	4.9%
High School Degree or GED	12.6%
Technical or Trade School	3.5%
Some College	25.2%
Associates Degree	11.9%
4-year College Degree	26.6%
Advanced Degree	15.4%
Ethnicity	
African American	55.7%
Caucasian	25.5%
Asian	6.0%
Hispanic/Latino	4.0%
Native American	2.7%
'Other'	6.0%
Alcohol use, Negative Affect, & Impulsivity	
AUDIT Total Score	1.76 (2.04)
EIS Total	4.17 (3.32)
CES-D Total	5.26 (4.53)

Note. Data are presented as % of the current sample or mean (*SD*), when appropriate. AUDIT = Alcohol Use Disorders Identification Test; EIS = Eysenck Impulsiveness Scale; CES-D = The Center for Epidemiologic Studies Depression Scale.

Table 2

Pearson's correlations between study measures and AUDIT scores.

Variable	1	2	3	4	5	6	7
1. Age	1.00						
2. Income	.29**	1.00					
3. Education	.41**	.42**	1.00				
4. CES-D	−.18*	−.29**	−.23**	1.00			
5. Eysenck	−.25**	−.26**	−.30**	.25**	1.00		
6. DT	−.22*	−.09	−.14	.18*	.13	1.00	
7. AUDIT Total	−.09	.19	−.12	.24**	.11	.12	1.00

Note.

*
$p < .05$,

**
$p < .01$;

Higher education scores indicate higher levels of education; DT = distress tolerance; Distress tolerance is dichotomized such that low DT = 1 and high DT = 0.

Table 3

Tobit regression models examining the unique and interactive effects of distress tolerance and current depressive symptoms on problematic alcohol use

Variable	Coefficient	SE	t Statistic	p Value
Omnibus Model				
CES-D Total [**]	0 .71	0.24	2.90	< .01
DT	0.94	0.50	1.90	.06
DT × CES-D [*]	−0.33	0.13	−2.54	.01
Low DT Model				
CES-D Total [*]	0.16	0.08	2.07	.04
High DT Model				
CES-D Total	0.07	0.06	1.31	.19

Note.

[**] $p < .01$,

[*] $p < .05$;

CES-D Total = Total scores on The Center for Epidemiologic Studies Depression Scale; DT = whether or not (dichotomous) participants quit the PASAT-C; Low DT = those that quit the PASAT-C prior to the end of the task; High DT = those that persisted the entire duration of the PASAT-C.