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Daily associations between emotional functioning and alcohol involvement: Moderating effects of response inhibition and gender

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ABSTRACT

Background: Research has linked tonic and variable mood to problematic alcohol use, both between- and within-subjects. Indices of behavioral control have moderated these links, at least at the between-subjects level. The current study examines daily associations between indices of emotional functioning and alcohol involvement as a function of response inhibition.

Methods: College student drinkers ($n = 74$; 58.11% female) were enrolled in a study on emotion and alcohol use. Participants completed a stop-signal task as an index of response inhibition. They then carried a personal data device for 21 days, reporting daily on mood, alcohol use, and acute alcohol use disorder symptoms. Mood instability was the mean square of successive differences from daily mood assessments.

Results: There were 1309 person days (622 drinking days) available for analysis. Pre-drinking mood instability was positively associated the likelihood of drinking and drinks consumed on drinking days. The former association was diminished among women with high response inhibition. Pre-drinking positive mood was positively associated the likelihood of drinking and drinks consumed on drinking days. The latter association was diminished among women with high response inhibition. Pre-drinking negative mood was positively associated with drinks consumed on drinking days among women with low response inhibition. Finally, pre-drinking positive mood was associated with acute alcohol use disorder symptoms among those with low response inhibition.

Conclusions: These results suggest that interventions targeting positive mood may be particularly important. Further, developing ways to improve response inhibition control may broadly influence negative drinking outcomes by affecting multiple mood-drinking associations.

1. Introduction

Several theoretical models posit that mood motivates alcohol use including the tension reduction hypothesis (Conger, 1956), self-medication hypothesis (Khantzian, 1997), affective processing model of negative reinforcement (Baker et al., 2004), stressor-vulnerability model (Cooper et al., 1988), and stress-response dampening model (Sher and Levenson, 1982). However, these models focus primarily on tonic levels of mood, and most have not considered potential moderators of mood-alcohol associations.

In addition to examining positive and negative mood, recent research has demonstrated the utility of examining mood variability or instability in the context of alcohol use. Retrospective self-report studies suggest that mood instability is related to a host of alcohol-related outcomes including alcohol-related problems (Kuvaas et al., 2013; Simons, 2003; Simons et al., 2004) and dependence symptoms (Simons et al., 2009; Stevenson et al., 2015). However, these studies are limited by retrospective recall biases.

To overcome recall biases, researchers have examined mood-alcohol associations in near-real time using ecological momentary assessment (EMA; Shiffman, 2009). Several EMA studies demonstrate relationships between mood and alcohol use (see Armeli et al., 2000; Dvorak et al., 2014; Dvorak and Simons, 2014; Hussong et al., 2001; Mohr et al., 2005; Simons et al., 2010), though these studies tend to focus on level of mood rather than mood dynamics. In a notable exception, Gottfredson and Hussong (2013) used

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EMA to demonstrate that mood variability (operationalized using standard deviations) was related to increased drinking at both the between-subject and within-subject levels.

Mood instability represents moment-to-moment mood fluctuations, reflecting both high variability and low temporal dependency. Whereas standard deviations capture variability and autocorrelations capture temporal dependency, mood instability seems to be best captured by the mean square of successive difference (MSSD; Ebner-Priemer et al., 2009; Jahng et al., 2008; Trull and Ebner-Priemer, 2009) as it accounts for both variability and temporal dependency. In the present study, we focus on mood instability as an indicator of emotion dysregulation that is associated with alcohol-related outcomes above and beyond the effects of positive and negative mood.

Although multiple theoretical accounts justify why mood instability should relate to alcohol-related outcomes, we focus on the strength model of self-control (SMSC; Muraven and Baumeister, 2000), which considers problematic alcohol use as self-regulation failure. Based on numerous SMSC studies, regulating one's mood is thought to use limited self-control resources (Baumeister et al., 1998). According to this model, more frequent attempts of mood regulation can lead to a state of diminished effortful resources, resulting in problematic alcohol use (*i.e.*, heavy alcohol use and/or experiencing more AUD symptoms). Indeed, recent research has indicated it is the regulation of mood, rather than elevated mood states generally, that results in the depletion of effortful resources (Bruyneel et al., 2009). Providing evidence of the SMSC within the context of problematic alcohol use, Muraven et al. (2005) found that self-control demands during the day, which include tasks such as trying to suppress negative emotions, predicted violations of individual drinking limits. Interestingly, this depletion effect may be less pronounced among those with higher "trait" levels of behavioral control (Dvorak and Simons, 2009; Gailliot and Baumeister, 2007; Muraven et al., 2005).

Although assessed using a wide range of distinct measures, recent reviews and meta-analyses (e.g., Smith et al., 2014; Wilcox et al., 2014) have indicated that deficits in behavioral control are associated with problematic alcohol use. Furthermore, there is emerging evidence that indices related to behavioral control moderate the association between mood instability and alcohol-related problems. Using cross-sectional data, Simons et al. (2004) found that the positive relationship between mood instability and alcohol-related problems was strongest among individuals with high self-report impulsivity (*i.e.*, low behavioral control). Similarly, Stevenson et al. (2015) found the positive association between mood instability and alcohol dependence symptoms was diminished among individuals with better Stroop performance (*i.e.*, high behavioral control). In a prospective study, Simons et al. (2009) found that mood instability was a stronger predictor of alcohol abuse symptoms six months later among those with higher self-report impulsivity (*i.e.*, low behavioral control). Thus, there is growing evidence that associations between unstable mood and problematic use are strongest among individuals with diminished behavioral control. However, this has yet to be examined at the daily level.

Building off this research, the present study proposes that mood instability results in a depletion of effortful resources, and this effect may be less pronounced among those with better behavioral control. Overall, we expected that mood instability would predict alcohol outcomes (*i.e.*, alcohol use and AUD symptoms) above and beyond positive and negative mood, and that response inhibition (RI), a behavioral index related to behavioral control, would moderate mood-alcohol associations such that these associations were strongest among those with lower RI (*i.e.*, deficits in behavioral control). Finally, we explored gender as a moderator of these associations.

2. Methods

2.1. Participants

Participants ($n = 74$; 58.11% female) were recruited from a Midwest university for a study examining emotion and alcohol use. The sample ranged in age from 18 to 29 years ($M = 21.30$, $SD = 2.07$). Ninety-one percent of the sample was White, 1% was Black, 3% was Native American/Alaskan Native, 4% was Asian, and 1% was other.

2.2. Procedure

This study consisted of two phases. During Phase I, participants ($n = 1875$) completed an online screen for Phase II (the EMA phase). Participants who met enrollment criteria (drinking 2–4 times per month) were invited to participate in Phase II ($n = 460$). The first 80 individuals who responded to the invite were scheduled for a lab appointment where they completed informed consent, baseline lab assessments of neuropsychological functioning including RI, and training in the use of the personal data device (PDD). The PDD training included: (1) a review of PDD schedule of events (*i.e.*, random assessments and self-assessments), (2) education on a "standard" alcoholic drink using the NIAAA standard drink card, (3) discussion of acute alcohol use disorder symptoms (these were described as 'alcohol-related problems'—for each symptom an example was given), and (4) procedures in the event of loss, theft, or device error. Participants carried the PDD for the next 21 days. Participants were compensated $20 for the initial appointment, $0.50 for each completed random assessment and $1.00 for each completed morning assessment.

2.2.1. Ecological momentary assessments (EMA). EMA participants responded to three assessments on the PDD: morning (a self-initiated assessment occurring between 8:00AM–10:00AM), random mood/drinking assessments (occurring randomly nine times per day between 8:00AM–2:00AM), and an evening assessment (not used here). Morning assessments primarily examined alcohol use variables. Random assessments primarily assessed current mood and drinks consumed (if currently drinking). Participants could set the PDD to 'Vibrate' and could postpone random assessments for up to 10 min. All assessments were date and time stamped.

2.3. Measures

2.3.1. Emotional functioning. Emotional functioning was assessed by 18 items from subscales of the PANAS-X (Watson and Clark, 1999) and Larsen and Diener's (1987) mood circumplex. Each item asked "How ____ are you feeling right now?" with responses on a scale of 1 (not at all) to 11 (extremely). Five facets of mood were selected. Four negative mood states—anxiety (anxious, nervous, jittery; $\alpha = .84$), anger (angry, frustrated, irritated, tense; $\alpha = .89$), stress (stressed, overwhelmed; $\alpha = .84$), and sadness (down, blue, depressed, sad; $\alpha = .93$)—were combined to form a negative mood indicator ($\alpha = .83$). Five positive mood states (excited, enthusiastic, energetic, happy, joyful; $\alpha = .93$) were used to form the positive mood indicator. Mood Instability was a standardized variable formed using the mean square of successive difference (MSSD) for each primary mood state above ($n = 5$) across random assessments ($\alpha = .70$). Previous research supports the use of MSSD as a measure