Drug and Alcohol Dependence xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Full length article

Negative urgency, mood induction, and alcohol seeking behaviors

J. Davis VanderVeen[a,*], Martin H. Plawecki[b], James B. Millward[b], James Hays[b], David A. Kareken[b,c], Sean O'Connor[b,d], Melissa A. Cyders[a]

[a] Indiana University—Purdue University Indianapolis, Department of Psychology, 402 N Blackford St., Indianapolis, IN, 46202, USA
[b] Indiana University School of Medicine, Department of Psychiatry, 355 W 16th St., Indianapolis, IN, 46202, USA
[c] Indiana University School of Medicine, Department of Neurology, 355 W 16th St., Indianapolis, IN, 46202, USA
[d] R.L. Roudebush VAMC, Indianapolis, 1481 West 10th St., Indianapolis, IN, 46202, USA

ARTICLE INFO

Article history:
Received 31 January 2016
Received in revised form 27 May 2016
Accepted 30 May 2016
Available online xxx

Keywords:
Intravenous (IV) alcohol administration
Negative urgency
Mood induction
Alcohol seeking
Alcohol consumption

ABSTRACT

Background: Negative urgency, defined as impulsive risk-taking during extreme negative emotional states, is the most important impulsivity-related trait for alcohol-related problems and alcohol dependence. However, how negative urgency imparts risk for alcohol-related problems is not yet well understood. Therefore, the goal of the current study was to examine how negative urgency relates to separable aspects of the emotional experience and alcohol-seeking behaviors.
Methods: A total of 34 (19 women) community-dwelling, alcohol-using adults aged 21–32 (mean age = 24.86, SD = 3.40, 74.3% Caucasian) completed two counterbalanced intravenous alcohol self-administration sessions: one during a neutral mood condition and one during a negative mood condition.
Results: Negative urgency was associated with 1) greater mood change following negative mood induction ($F = 4.38$, $df = 15$, $p = 0.002$, $\eta 2 = 0.87$), but was unrelated to changes in craving or cortisol release in response to mood induction; 2) greater alcohol craving prior to and after an alcohol prime ($F = 3.27$, $p = 0.02$, $\eta 2 = 0.86$), but only in the negative and not the neutral mood condition; and 3) higher peak BrAC ($F = 2.13$, $df = 42$, $p = 0.02$, $\eta 2 = 0.48$), continuing to increase intoxication level over a longer period ($F = 3.77$, $df = 42$, $p < 0.001$, $\eta 2 = 0.62$), and more alcohol seeking ($F = 21.73$, $df = 22$, $p < 0.001$, $\eta 2 = 0.94$) throughout the negative session. Negative urgency was associated with overall lower cortisol release.
Conclusions: These results highlight the importance of assessing behavioral indicators of negative urgency under mood condition, and suggest that negative urgency may amplify alcohol self-administration through increased negative emotional reactivity to mood events and increased alcohol craving after initial alcohol exposure, leading to maintenance of alcohol related behavior.

1. Introduction

Negative urgency, defined as impulsive risk-taking behavior during extreme negative emotional states, is the most important impulsivity-related trait for alcohol-related problems and alcohol dependence (Coskunpinar et al., 2013; see Cyders and Smith, 2008 for review of urgency theory). There is an emerging consensus that negative urgency is a transdiagnostic endophenotype for a wide range of clinical disorders, most notably alcohol use problems (see a review by Cyders et al., in press-a, in press-b and Verdejo-García et al., 2010). Although evidence suggests negative urgency plays a predictive role in problematic alcohol-related behaviors (Coskunpinar et al., 2013; Settles et al., 2010), the mechanisms by which negative urgency imparts risk for alcohol-related problems is not yet well understood. Although, negative mood influences multiple types of alcohol-related behaviors (Cyders et al., in press-a, in press-b), it remains unclear how negative urgency might relate to these separate aspects of mood, alcohol seeking, and consumption. This lack of understanding limits the development of effective treatment and prevention strategies that would mitigate negative urgency's influence on clinical problems; therefore, the goal of the current study was to examine potential mood and alcohol-related mechanisms underlying negative urgency's effects on alcohol seeking behaviors.

Research on negative urgency has begun to unravel potential neurocognitive underpinnings associated with its increased risk. Although some reports suggest that negative urgency is unrelated to the intensity or frequency of self-reported emotion (e.g., Cyders

* Corresponding author.
E-mail address: jodavand@iupui.edu (J.D. VanderVeen).

http://dx.doi.org/10.1016/j.drugalcdep.2016.05.026
0376-8716/

et al., 2009; Cyders and Coskunpinar, 2010), others suggest a relationship between negative urgency and physiologic correlates of emotional reactivity (e.g., Cyders et al., 2014), which then subsequently influence alcohol-seeking (e.g., Carney et al., 2000; Steptoe and Wardle, 1999). Proposed mechanisms include increased emotional reactivity (e.g., Albein-Urios et al., 2013; Cyders et al., 2014), increased attention to and salience of reward cues (e.g., Chester et al., in press; Cyders et al., 2014), increased reward circuitry activation (e.g., Wilbertz et al., 2014; Xue et al., 2010), and decreased ability to regulate emotional experiences (e.g., Hoptman et al., 2014; Muhlert and Lawrence, 2015). However, research has yet to directly examine these factors, perhaps in part because of limitations in the ability to measure alcohol related behaviors in experimental contexts.

The current study used the Computer-Assisted Alcohol Infusion System (CAIS; Plawecki et al., 2013; Zimmermann et al., 2008, 2009) to examine how negative urgency relates to alcohol and alcohol-related behaviors. Oral consumption results in a high variability of the time course of consequent breath alcohol concentrations (BrACs) across individuals (Ramchandani et al., 2009), which in turn confounds experimental interpretation. Therefore, the present study used intravenous alcohol self-administration because, compared to oral alcohol administration, it allows for safely administering more ecologically valid doses of alcohol, better controls and predicts BrAC so that subsequent infusion does not place one over a predetermined safety limit while ensuring consistency and accuracy in the application of infusion rate and dose, and ensures a consistent time course of brain alcohol exposure per alcohol reward across individuals (Gomez et al., 2012). CAIS directly controls the rate of IV alcohol administration, based on predictions of a physiologically based pharmacokinetic model with parameters tailored to the individual subjects (Plawecki et al., 2007; Ramchandani et al., 1999). We included two behavioral measures of IV alcohol seeking: self-administration of freely available alcohol for enjoyment (Free Access, FA) and self-administration requiring progressive work (PW) assessing motivation for access to successive alcohol rewards.

The goals of the current study were to examine how negative urgency relates to the effects of both negative mood induction and alcohol exposure on self-reported affect, cortisol, and craving. We also sought to determine how negative urgency is related to different alcohol-related behaviors (craving, ad lib consumption (FA), and work exerted to gain access to alcohol reward (PW; Hobbs et al., 2005)).

We hypothesized that greater negative urgency would be related to: 1) greater mood change from negative mood induction (e.g., Albein-Urios et al., 2013; Cyders et al., 2014); 2) greater cortisol release to negative mood induction (increased physiologic reactivity in Cyders et al., 2014); 3) greater alcohol craving in response to an alcohol prime following negative mood induction (e.g., Chester et al., in press; Cyders et al., 2014); 4) greater cortisol release to the alcohol prime (e.g., increased physiologic reactivity in Cyders et al., 2014); 5) higher peak BrAC in the negative mood session (e.g., Coskunpinar et al., 2013; Settles et al., 2010); and 6) more work for alcohol rewards in the negative mood session (e.g., Carney et al., 2000; Steptoe and Wardle, 1999).

2. Materials and methods

2.1. Participants

Participants were community-dwelling, alcohol-using men and women. Two samples were collected as part of a larger study of the effects of negative mood on alcohol self-administration across men and women (Cyders et al., in press-a, in press-b): the FA sample, which was able to freely self-administer alcohol up to a maximal BrAC of 150 mg/dL ($n = 14$), and the PW sample, which completed progressively longer work sets for alcohol rewards with a maximum BrAC of 120 mg/dL ($n = 20$). Inclusion/exclusion criteria for both samples included: 21–35 years old, current alcohol users, good medical and mental health, able to understand and complete questionnaires in English, no past or present alcohol dependence, not currently pregnant or intending to become pregnant, or breastfeeding. The FA sample was recruited for social drinking (at least 4 standard drinks per week and at least two binge episodes per month- defined as 4 or more drinks at a time for women and 5 or more drinks at a time for men; NIH, 2014). The PW sample was recruited for heavier social drinking (consuming at least 7 drinks per week and at least one binge episode per week). The difference in recent drinking history reflected the reality that the PW paradigm requires more motivation (i.e., more effort to gain access to alcohol) than FA. It also reflects our experience that heavier drinkers performing the FA paradigm often rapidly reach the maximum allowable BrAC: a ceiling effect limiting interpretation. Given that a majority of study variables were obtained prior to completing the PW or FA paradigms specific tasks and that we employed a within-subject experimental design, the two samples were combined for all analyses with the exception of the PW-specific outcome variables.

2.2. Measures and materials

2.2.1. The UPPS-P impulsive behavior scale- revised. The UPPS-P impulsive behavior scale- revised (UPPS-P; Lynam et al., 2006) is a 59 item self-report scale, with responses ranging from 1 (agree strongly) to 4 (disagree strongly). The UPPS-P is designed to measure five sub-facets of trait impulsivity: sensation seeking, lack of planning, lack of perseverance, positive urgency, and negative urgency. The present study only used the negative urgency subscale, which had adequate reliability ($\alpha = 0.86$). Items were coded so that higher mean scores represented higher levels of negative urgency.

2.2.2. The affect grid. The affect grid (Russell et al., 1989) is a single-item, 2-dimensional scale designed to assess current mood along orthogonal axes of pleasure-displeasure and arousal-sleepiness. It has adequate correlations with other, longer measures of current mood states, such as the Mehrabian and Russell (1974) scale ($r = 0.77$), making it a more practical measure of current emotional ambience. In the present study, the pleasure-displeasure axis of the affect grid was used as a check for the effectiveness of the mood manipulation, with higher values indicating more pleasure.

2.2.3. The alcohol use disorders identification test. The alcohol use disorders identification test (AUDIT; Saunders et al., 1993) is a ten-item scale that assesses hazardous alcohol consumption, abnormal alcohol consumption behavior, and alcohol related problems. Data obtained by the AUDIT allows for discriminating between hazardous and non-hazardous drinkers and responses show concurrent validity with other measures of alcohol use (Saunders et al., 1993). In the current study, the AUDIT was used to exclude participants with moderate to severe scores (AUDIT ≥ 16; Saunders et al., 1993).

2.2.4. Subjective craving. Subjective experiences were assessed with 4-items taken from the alcohol urge questionnaire (Bohn et al., 1995): "Having a drink now would make things seem just perfect"; "I want a drink so bad I can almost taste it"; "Nothing would be better than having a drink right now"; and "I crave a drink right

Please cite this article in press as: VanderVeen, J.D., et al., Negative urgency, mood induction, and alcohol seeking behaviors. Drug Alcohol Depend. (2016), http://dx.doi.org/10.1016/j.drugalcdep.2016.05.026