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Short communication

Executive function and appetitive processes in the self-control of alcohol use: The moderational role of drinking restraint

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ABSTRACT

Background: Dual process models characterize hazardous drinking as a function of appetitive processes and executive processes that enable self-control. Although central to a number of models (e.g., Hofmann et al., 2009a,b), little empirical research has examined how drinking restraint may influence the effects of these processes on alcohol use. The current study examined whether drinking restraint influenced the predictive value of appetitive responses to alcohol cues and executive functioning on typical drinking behavior. It was hypothesized that the interaction between appetitive responses and executive functioning would only be observed among those who had stronger drinking restraint goals.
Methods: Sixty-nine hazardous drinking young adults (ages 21–30) completed the Trail Making Test and then were exposed to the sight and smell of an alcoholic beverage that they anticipated they would consume. Urge and anticipated stimulant effects of alcohol (A-BAES) were measured following the exposure.
Results: The interaction between Trails B and each of the appetitive response ratings (i.e., urge rating and A-BAES) was predictive of drinking behavior (TLFB) only among those high in drinking restraint.
Conclusions: These findings highlight the importance of incorporating the role of motivational constructs such as restraint goals in current dual process models of alcohol-related self-control.

1. Introduction

A number of dual process models have characterized alcohol use as a function of two sets of processes: appetitive processes that are automatically elicited by alcohol related cues (Hofmann et al., 2008a,b; Lovinger, 2008) and conscious controlled processes that facilitate self-regulation (Hofmann et al., 2009a,b; Muraven et al., 2002; Tiffany, 1999; Wiers et al., 2013). Increasing evidence has demonstrated the critical role of executive functioning (EF) in self-control, including the ability to maintain and update information in working memory, to inhibit select behaviors, and to shift between sets of information or tasks (Hofmann et al., 2011, 2012; Miyake et al., 2000). Stronger EF has been associated with personal awareness of alcohol-related problems and greater control over consumption (Blume et al., 1999, 2000; Hofmann et al., 2009a,b).

The extent to which appetitive responses are associated with alcohol consumption appears to be moderated by self-control resources (Ostafin et al., 2008). Implicit measures of appetitive responses to alcohol are more strongly associated with alcohol consumption for those with weaker or weakened EF (see Wiers et al., 2013). However, the association between appetitive responses and alcohol use may not only be influenced by the ability to inhibit appetitive responses but also the desire to do so as reflected in standards that individuals have for limiting alcohol use (Bechara, 2005; Hofmann et al., 2008a,b). Although there is some evidence to suggest that situational restraint goals may moderate the impact of EF on alcohol responses (Sharbanee et al., 2012), there is little known about how individual differences in the desire to restrain drinking may moderate the interaction between appetitive responses and EF. Moreover, it has yet to be determined whether the pattern of results is limited to automatic response to alcohol cues or if it represents a more general tendency for EF to moderate appetitive responses to alcohol cues.

Conscious representations of appetitive response (i.e., urge versus implicit measure) may serve an additional function for those who have high restraint goals. According to counteractive control theory (Myrseth et al., 2009), temptation may actually increase efforts at self-control for those who have self-regulatory standards to control use. According to this view, stronger desire to use triggers self-control attempts, leading to reductions in use, but only among those who have the self-regulatory abilities to do so. Both of the above perspectives suggest that the influence of appetitive

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response on alcohol use will be moderated by EF, but only for those who have stronger restraint goals.

To test this issue, we examined whether the association between appetitive responses to alcohol cues induced in the laboratory and typical alcohol use among hazardous drinkers was moderated by EF and drinking restraint. Following previous work on drinking behavior among young adults (Blume et al., 2000; Crowe, 1998; Whitney et al., 2006), we employed the Trail Making Test (TMT; Reitan and Wolfson, 1985), which has been associated with dimensions of EF such as working memory, task-switching, and general cognitive flexibility (Kortte et al., 2002; O'Donnell et al., 1994; Salthouse, 2011; Sanchez-Cubillo et al., 2009). To assess standards related to drinking restraint, we utilized the restraint subscale of the temptation and restraint inventory (Collins and Lapp, 1992). It was hypothesized that appetitive responses and EF would interact to predict drinking behavior only among those who indicated higher desire to restrain drinking.

2. Method

2.1. Participants

Sixty-nine young (M = 21.83, SD = 1.68) male (n = 38) and female (n = 31) hazardous drinkers, identified by a score of 8 or more on the Alcohol Use Disorders Identification Test (AUDIT; M = 11.6, SD = 3.01) were recruited for the study though advertisements. Participants had to be between the ages of 21 and 35, speak English as their first language, and identify beer as their most frequently consumed alcoholic beverage. Sixty-one of the participants identified themselves as students. Participants reported drinking an average of 60.96 (27.40) alcoholic beverages per month on about 13 days over the past month (M = 13.08, SD = 4.34), consuming an average of 4.83 (2.03) drinks per occasion.

2.2. Measures

Subjects were asked to rate their "urge to drink alcohol" on an 11-point Likert scale (adapted from Monti et al., 1993) from 0 ("no urge at all") to 10 ("very strong urge"; Palfai and Ostafin, 2003). This measure is particularly well suited for assessing momentary desire strength (Ashrafioun et al., 2013; Kavanagh et al., 2013) and has been shown to be associated with alcohol consumption in laboratory and real life contexts (Palfai, 2006; Ostafin and Palfai, 2006). Following Sayette and Tiffany's (2013) peak provoked craving approach, urge rating taken prior to anticipated consumption served as the main independent variable. To assess the anticipated stimulant effects of alcohol consumption, participants completed the anticipated biphasic alcohol effects scale (A-BAES; Earleywine, 1994). The scale includes a series of stimulant subscales on which subjects indicated to what extent, from 0 ("not at all") to 10 ("extremely"), they expected alcohol consumption to make them feel (e.g., elated, energized; Earleywine, 1994; Martin et al., 1993). To measure alcohol consumption in the past month, we used the self-report calendar-based measure, Time Line Follow Back-30 (TLFB; Sobell et al., 1988). Finally, the Trail Making Task (TMT; Reitan and Wolfson, 1985) was used to measure EF in this study. This well-established test consists of two parts, A and B, as well as a practice set for each. Total time to complete Part B was used as the EF index. The restraint subscale of the temptation and restraint inventory (TRI) was used to assess standards related to drinking restraint (Collins and Lapp, 1992). This three-item Likert-type scale measure assesses the degree to which individuals are attempting to restrict alcohol use.

2.3. Procedures

Following informed consent, participants provided breath alcohol samples and confirmed they had neither consumed alcohol in the past 12 h nor eaten within 3 h of the study. Women completed a pregnancy test. Participants then completed a series of baseline measures including the TLFB-30 days, the TMT, and individual difference measures. After a 5-min break, participants completed an urge to drink alcohol measure and then were exposed to two glasses of beer that they anticipated they would be consuming. The amount of beer in each glass was consistent with a target BAC of 40 mg/dl based on gender and weight. Participants then completed the urge to drink measure a second time (anticipation rating) and the measure of anticipated effects of the beer (A-BAES) was presented to them. The University Institutional Review Board approved these procedures.

3. Results

Independent variables were centered before interaction terms were computed. To reduce the influence of outliers, the square root of participants' past 30-day alcohol consumption was calculated and regressed onto a fixed sequence of predictors. Hierarchical linear regression analyses were conducted to examine the interaction between Trails B, cue responses (i.e., anticipated urge to drink alcohol, anticipated stimulant effects of consumption), and drinking restraint. To control for gender differences in alcohol use, participant sex was entered in the first step of all regression analyses. In the second step, mean centered urge to drink (or A-BAES) ratings, Trails B time, and restraint scores were entered. Two-way interaction product terms for the mean-centered predictors and the three-way interaction terms were entered in the third and fourth steps, respectively.

For urge to drink analyses, results showed a significant 3-way interaction (R-squared change = .055, F = 4.021, p < .05). The interaction between urge-to-drink and Trails B was probed at high (1SD+) and low (1SD-) levels of restraint as shown in Fig. 1a and b. As hypothesized, the pattern of interaction between urge ratings and Trails B was only significant among those high in restraint ($beta$ = .029, t = 2.35, p < .03), not among those low in restraint ($beta$ = −.004, t = −.37, p = ns). Further probing of the three-way interaction (Aiken and West, 1991) using simple slopes at high levels (+1SD) of restraint did not reveal a significant simple slope for those high (+1SD) in EF ($beta$ = .22, t = −1.60, p = ns) or those low in EF ($beta$ = .19, t = 1.77, p = ns).

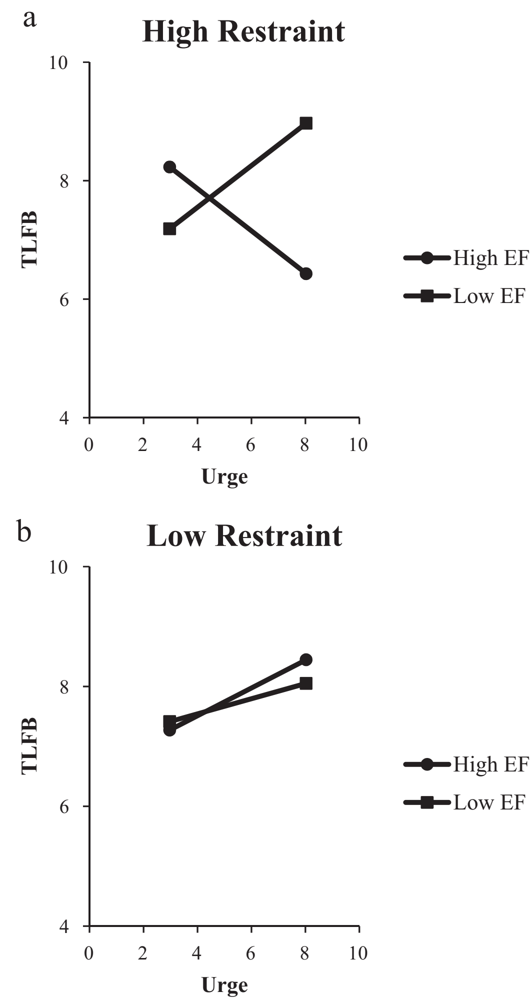

Fig. 1. (a) Executive function (EF) moderates the association between urge and drinking behavior (TLFB) among individuals high in restraint. (b). Interaction between urge, executive function (EF), and drinking behavior (TLFB) is n.s. for individuals low in restraint.