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Impulsivity and Alcohol Demand in relation to Combined Alcohol and Caffeine Use

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Abstract

Problematic alcohol use among college students continues to be a prominent concern in the United States, including the growing trend of consuming caffeine with alcoholic beverages (CABs). Epidemiologically, CAB use is associated with incremental risks from drinking, although these relationships could be due to common predisposing factors rather than specifically due to CABs. This study investigated the relationship between CAB use, alcohol misuse, and person-level characteristics including impulsive personality traits, delayed reward discounting, and behavioral economic demand for alcohol use. Participants were 273 regularly drinking undergraduate students. Frequency of CAB use was assessed over the past month. A multidimensional assessment of impulsivity included the UPPS-P questionnaire and a validated, questionnaire-based measure of delayed reward discounting. Demand was assessed via a hypothetical alcohol purchase task. Frequency of CAB consumption was significantly higher in males compared to females and was also associated with higher impulsivity on the majority of the UPPS-P subscales, steeper delayed reward discounting, and greater demand for alcohol. Significant correlations between CAB use and both alcohol demand and lack of premeditation remained present after including level of alcohol misuse in partial correlations. In a hierarchical linear regression incorporating demographic, demand, and impulsivity variables, CAB frequency continued to be a significant predictor of hazardous alcohol use. These results suggest that although there are significant

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associations between CAB consumption and gender, impulsivity, and alcohol demand, CAB use continues to be associated with alcohol misuse after controlling for these variables.

Keywords

Alcohol; Caffeine; Impulsivity; Demand; Delayed reward discounting

Introduction

Heavy drinking and other forms of problematic alcohol use among college students continue to be a prominent concern in the United States (Hingson, Zha, & Weitzman, 2009; Task Force on College Drinking, 2002). The risks associated with alcohol misuse in these individuals include motor vehicle accidents from intoxicated driving, injuries, and physical and sexual assaults (Hingson et al., 2009). Alcohol use disorders are also prevalent, with 24% of male and 13% of female college students meeting diagnostic criteria for either alcohol abuse or dependence (Slutske, 2005). Although this gender gap has narrowed over time (e.g., Grucza, Norberg, & Bierut, 2009), most studies continue to show that rates of daily drinking (Johnston, O'Malley, Bachman, & Schulenberg, 2012) and binge drinking (Johnston et al., 2012; Substance Abuse and Mental Health Services Administration, 2012) remain higher among men compared to women. This is particularly true for extreme levels of binge drinking (i.e., consuming 10 or more drinks in a row) (Johnston et al., 2012). Drinking patterns during college-age years also significantly predict development of an alcohol use disorder up to a decade later (Dick, Aliev, Viken, Kaprio, & Rose, 2011; Merline, Jager, & Schulenberg, 2008; O'Neill, Parra, & Sher, 2001), further underscoring the importance of research aimed at elucidating mechanisms of problematic drinking in this population.

A popular drinking trend among adolescents and young adults involves consumption of caffeine with alcoholic beverages (CABs). Surveys of college students in the United States and Australia indicate that between 25-65% consume CABs (Marczinski, 2011; O'Brien, McCoy, Rhodes, Wagoner, & Wolfson, 2008; Peacock, Bruno, & Martin, 2012; Snipes & Benotsch, 2013). Recent data indicate that CAB use may be especially prominent in males along with members of racial and sexual minority groups (Wells et al., 2013). Initially, CABs were frequently consumed in the form of premixed beverages that contained both alcohol and caffeine (e.g., Four Loko®), but these beverages have since been taken off the market following warnings from the Food and Drug Administration (FDA, 2010). However, beverages that are spontaneously prepared (ad hoc) within a drinking episode (e.g., Red Bull® and vodka, "Jager bombs") remain common. Young adults consume CABs for a variety of reasons, including the belief that stimulation from caffeine will allow them to drink longer and get drunk faster (MacKillop et al., 2012; Marczinski, 2011). Expectancies of enhanced alcohol intoxication significantly correlated with frequency of CAB use in college drinkers, even after controlling for overall level of alcohol consumption (MacKillop et al., 2012). Furthermore, CAB use has also been shown to be correlated with higher frequency of heavy drinking episodes, higher probability of intoxication, increased likelihood of driving after drinking, and greater risk of alcohol-related injuries and assaults

(Brache & Stockwell, 2011; O'Brien et al., 2008; Thombs et al., 2010). Laboratory studies of the acute effects of CABs provide a unique perspective on the potential mechanisms of CAB risk. Studies have shown that combining caffeine with alcohol lowers subjective intoxication (e.g., Ferreira, De Mello, Pompéia, & De Souza-Formigoni, 2006; Heinz, de Wit, Lilje, & Kassel, 2013; Marczyński & Fillmore, 2006), but corresponding behavioral impairments in reaction time, response inhibition, and driving performance may not be counteracted (e.g., Ferreira et al., 2006; Howland, Rohsenow, Arnedt, et al., 2011; Marczyński, Fillmore, Bardgett, & Howard, 2011; Marczyński, Fillmore, Henges, Ramsey, & Young, 2012). However, contrary findings have also been reported (for a review, see Verster, Aufricht, & Alford, 2012). Finally, independent of adding alcohol, energy drink consumption alone has been found to be associated with higher frequency of emergency room visits (Substance Abuse and Mental Health Services Administration, 2013) and higher prevalence of alcohol dependence (e.g., Arria et al., 2011). As a result of this research, addiction researchers and health professionals have emphasized CAB consumption as a significant public health concern (Howland, Rohsenow, Calise, MacKillop, & Metrik, 2011; Howland & Rohsenow, 2013; Reissig, Strain, & Griffiths, 2009).

Person-level factors that are associated with CAB consumption may also be important to investigate because certain types of drinkers may be more inclined toward CAB use and also to be more inclined to excessive alcohol consumption in general along with engaging in other risk-taking behaviors (Howland & Rohsenow, 2013). More specifically, it may be that risk taking propensity serves as a classic third variable confound in this relationship: the correlation between CAB use and heavy drinking or risk taking could actually be due to these common underlying predisposing factors rather than specifically due to CAB use (Alford, Hamilton-Morris, & Verster, 2012; Howland & Rohsenow, 2013). This possibility has not been sufficiently investigated.

Three particularly promising domains are consistently associated with alcohol misuse in general and may also be associated with CAB use. These are impulsive personality traits, delayed reward discounting and behavioral economic demand for alcohol. Impulsive personality traits are increasingly recognized as being multifaceted in nature, reflecting a range of behavioral tendencies from inappropriate responses to lack of adequate premeditation before action (e.g., Cyders & Coskunpinar, 2011; de Wit, 2009). One model of impulsivity – the UPPS model (Whiteside & Lynam, 2001) – is comprised of four dimensions: Urgency (i.e., acting impulsively in negative emotional states), lack of premeditation (i.e., acting without sufficient forethought), lack of perseverance (i.e., tendency to leave tasks unfinished and succumb to distractions), and sensation seeking (i.e., propensity to try and enjoy activities that are exciting or dangerous). A fifth facet of positive urgency (i.e., acting impulsively in positive emotional states) has been added more recently (UPPS-P; Lynam, Smith, Whiteside, & Cyders, 2007). Prior research has reported significant associations between the individual UPPS-P subscales and measures of hazardous alcohol use (e.g., Cyders, Flory, Rainer, & Smith, 2009; Magid & Colder, 2007; Verdejo-Garcia, Bechara, Recknor, & Perez-Garcia, 2007; Whiteside & Lynam, 2003). Delayed reward discounting is a behavioral economic index of impulsivity that captures preferences for smaller-immediate rewards over larger-delayed rewards that are discounted in value due to their temporal delay (Madden & Bickel, 2009). It is a decision-making index

that is distinct from personality measures of impulsivity (Cyders & Coskunpinar, 2011). Impulsive delayed reward discounting has been consistently implicated in a range of addictive behaviors, including robust associations with severity of alcohol misuse in both cross sectional and longitudinal studies (for a meta-analysis and review, see MacKillop et al., 2011).

In contrast to the preceding variables, which assay aspects of impulsivity, behavioral economic demand for alcohol refers to the quantitative relationship between alcohol consumption and cost, and putatively indicates the value of alcohol as a reinforcer to the individual. Alcohol demand is typically assessed via hypothetical alcohol purchase tasks (APT) that measure an individual's consumption preferences at escalating levels of price. Significant associations between indices of alcohol demand and level of alcohol use and misuse have been reported in several studies (Amlung, Acker, Stojek, Murphy, & MacKillop, 2012; MacKillop et al., 2009, 2010; Murphy, MacKillop, Skidmore, & Pederson, 2009; Murphy & MacKillop, 2006). Demand has also been found to predict treatment outcomes following a brief motivational intervention in college student drinkers (MacKillop & Murphy, 2007).

Together, these variables reflect good candidates for characteristics that are associated with CAB use, but almost no studies to date have specifically examined these relationships. A recent study by Heinz et al. (2013) reported correlations between CAB use and higher ratings of positive urgency and lack of premeditation on the UPPS-P. Furthermore, Brache & Stockwell (2011) provided initial evidence that CAB use was significantly associated with heavy drinking and negative consequences from alcohol, even after controlling for risk-taking propensity. However, the measure of risk-taking in their study only focused on a single aspect of impulsivity (sensation seeking). The goal of the current study was to investigate the interrelationships among CAB use, impulsive personality traits, delayed reward discounting, demand for alcohol, and level of alcohol misuse. Incorporating the role of potential confounding variables is important from a public health perspective because it addresses the question of specificity of risk; namely, whether CAB use is specifically associated with alcohol misuse or whether an epiphenomenon associated with existing risk factors. We hypothesized that higher CAB frequency would be associated with greater levels of impulsivity on both the UPPS-P and delayed reward discounting, and with higher demand for alcohol. In addition, we hypothesized that CAB use would be associated with hazardous drinking above and beyond these impulsivity and demand variables.

Methods

Participants

Participants were 273 undergraduates at the University of Georgia who were at least 18 years of age and reported drinking alcohol on at least a monthly basis. An additional 43 participants were enrolled in this study, but these individuals were subsequently excluded due to reporting less than monthly alcohol consumption. Sample characteristics are provided in Table 1. Participants drank an average of 10.6 ($SD = 8.2$) drinks/week and had a mean Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) score of 8.4 ($SD = 5.0$, observed range 1-24) out of 40 indicating that, on

average, the present sample exhibited hazardous levels of drinking (e.g., Babor et al., 2001). Frequency of consuming CABs and non-alcoholic energy drinks is also presented in Table 1. Forty-five percent of participants reported consuming ad hoc CABs in the past month with typically occasional use (i.e., between 1-5 days in the last month). Participants reported consuming an average of 1.73 (SD = 0.98) CAB beverages per drinking episode. Energy drink consumption was also occasional, with 41% of participants consuming these beverages in the past month. Participants received psychology research credit or extra credit for participating.

Assessment

A comprehensive demographics measure assessed age, race, Hispanic ethnicity, and income. Weekly alcohol consumption was assessed using the Drinking Days Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985) and alcohol misuse was assessed using the AUDIT. Participants were asked the number of days in the past month that they consumed alcohol mixed with energy drinks. This question specifically referred to ad hoc CABs, with Red Bull and vodka and Jager bombs listed as examples in the item. Participants also reported the quantity of CABs that they typically consumed per occasion. Frequency of consuming energy drinks without alcohol (e.g., Red Bull, Monster) over the last month was also assessed. Impulsive personality traits were measured with the five UPPS-P subscales (Lynam et al., 2007): Urgency (Cronbach's $\alpha = .88$), lack of premeditation ($\alpha = .87$), lack of perseverance ($\alpha = .82$), sensation seeking ($\alpha = .86$), and positive urgency ($\alpha = .95$).

Delay Discounting—Delay discounting was measured with the multiple choice questionnaire (MCQ; Kirby, Petry, & Bickel, 1999), comprised of 27 choices between smaller-immediate and larger-delayed monetary rewards preconfigured to provide estimates of DRD across three reward magnitudes. Level of impulsivity from the MCQ was quantified using an impulsive choice ratio (ICR), which reflected the proportion of choices of the smaller-immediate reward relative to all MCQ choices. Higher ICR values reflected greater impulsivity. Since the ICR values for each MCQ magnitude were highly correlated with each other ($r_s = .72-.82$, $p_s < .001$), only the ICR from the medium magnitude MCQ (hereafter referred to as MCQ-M ICR) was used for data analysis.

Alcohol Purchase Task—Demand for alcohol was assessed via a hypothetical APT (Murphy & MacKillop, 2006). Participants reported how many standard-sized drinks of their typical preferred alcoholic beverage they would purchase at 21 prices (range = FREE-\$10/drink) arranged in ascending order. Participants were given similar instructions as previous APT studies (i.e., assume a typical drinking situation, their current income level, no stockpiling of drinks for later consumption, and no access to other alcohol) (Amlung et al., 2012; Amlung & MacKillop, 2012). The following observed indices of alcohol demand were generated from the APT: Intensity (e.g., consumption when drinks were free); Breakpoint (e.g., the first price at which consumption was completely suppressed); and $O_{\max}$ (e.g., the maximum alcohol expenditure) (Murphy & MacKillop, 2006). Finally, elasticity of demand was derived using the following nonlinear exponential demand curve model (Hursh & Silberberg, 2008): $\ln Q = \ln Q_0 + k(e^{-\alpha P} - 1)$, where Q = quantity consumed, Q_0 = derived intensity, k = the range of the dependent variable (standard drinks) in logarithmic

units, P = price, and α = elasticity of demand. The overall mean performance was first analyzed for the best-fitting k parameter, which was determined to be 4.0 and was used for all individual demand curves.

Procedure

Data collection occurred in 90-minute group testing sessions in university classrooms. Participants initially provided informed consent, which was followed by oral instructions, and packets of questionnaires. Participants were informed that no data would be linked to their identifying information. All procedures were approved by the University of Georgia's Institutional Review Board.

Data Analysis

All variables were initially screened for missing data, outliers ($Z_s > 3.29$), and distribution abnormalities (Tabachnick & Fidell, 2001). Variables that were significantly skewed or non-kurtotic (Intensity, $O_{\max}$, and Elasticity) were transformed using square root transformations to normalize the data. The primary analyses were conducted in two steps. First, associations of CAB frequency and alcohol misuse (AUDIT) with the measures of impulsivity and alcohol demand were examined using Pearson's zero-order correlations with follow-up partial correlations, partialing out AUDIT score. This latter step was to evaluate whether the impulsivity and demand domains were associated with CAB use independently from AUDIT scores. Second, hierarchical linear regression was used in order to determine the specific relationship between CAB frequency and alcohol misuse after accounting for variance due to the effects of demographics, impulsivity and demand. To maximize power and reduce Type-I error, the first step of this model included only those variables that were significantly correlated with AUDIT scores at $p < .05$. CAB frequency was then entered in a second step in order to determine the incremental variance provided by CAB use. A significance level of $p < .05$ was used in all analyses.

Results

Preliminary analyses

No outlying values were detected for any variables. Missing or incomplete data were as follows: sex ($n = 10$), race ($n = 2$), income ($n = 1$), drinks/week ($n = 1$), MCQ ($n = 2$) and UPPS-P ($n = 1$). Self-reported alcohol consumption and expenditure on the APT was prototypic (see Figure 1 in Supplementary Materials). The exponential demand curve equation (Hursh & Silberberg, 2008) provided a good fit to the APT data (median $R^2 = .84$, inter-quartile range = .77-.91).

Interrelationships among Impulsivity, Alcohol Demand, and CAB Use

Intercorrelations among the impulsivity and demand variables are presented in Table 2, with statistically significant correlations observed within each of the three domains (e.g., among individual demand indices, among the UPPS-P subscales, etc.), but at highly varying magnitudes. Several significant associations were also present across domains. Higher negative urgency scores were similarly associated with greater demand for alcohol (Intensity, Breakpoint, $O_{\max}$) and decreased price sensitivity (Elasticity). The MCQ was not

significantly correlated with any of the UPPS-P impulsivity subscales or any of the demand indices. Males consumed CABs more frequently than females ($t(259) = 1.99, p < .05$), but no other demographic variables were significantly associated with CAB use ($ps > .54$). AUDIT total scores were higher for males ($t(261) = 3.49, p < .01$) and for those with higher income ($r = .13, p < .05$).

Pearson's correlations (r) between frequency of CAB use, alcohol misuse (AUDIT) and the collateral variables are presented in Table 2. Each of the indices of alcohol demand were significantly correlated with CAB use, indicating that CAB users exhibited higher demand for alcohol (i.e., greater Intensity, Breakpoint, and $O_{\max}$) and lower price sensitivity (i.e., Elasticity) on the APT. Each of the UPPS-P impulsivity subscales, with the exception of lack of perseverance, was significantly correlated with CAB use, indicating that higher impulsiveness was associated with more frequent CAB use. However, impulsive delay discounting on the MCQ was not significantly correlated with CAB use. Partial correlations revealed that Intensity of demand ($r_p = .14, p < .05$) and sensation seeking ($r_p = .12, p < .05$) continued to be significantly associated with CAB frequency when controlling for AUDIT total score. Trend-level associations were also observed for Breakpoint ($r_p = .11, p = .07$), $O_{\max}$ ($r_p = .12, p = .05$), Elasticity ($r_p = -.12, p = .06$), and lack of premeditation ($r_p = .11, p = .06$). Positive and negative urgency were not significantly associated with CAB use in partial correlations ($ps > .32$).

In the two-step hierarchical linear regression, step one comprised those variables that were significantly correlated with AUDIT at $p < .05$, including sex, income, all five APT demand indices, MCQ-M ICR, and all five subscales from the UPPS-P. CAB frequency was added to the model in the second step. The results of this analysis are presented in Table 3. The first model was significant, $R^2 = .41, F(12, 254) = 14.08, p < .001$. The addition of CAB frequency in step two of the model was also significant, although only 3% of incremental variance was provided by adding CAB use was relatively modest, $R^2 = .03$, overall $R^2 = .44, F(13, 254) = 14.32, p < .001$. After accounting for the variance attributed to demographics, alcohol demand, and impulsivity, CAB frequency was still a significant predictor of AUDIT total score.

Discussion

This study investigated the relationship between CAB use, alcohol misuse, and person-level characteristics including impulsive personality traits, delayed reward discounting, and behavioral economic demand for alcohol. As hypothesized, significant associations were present between greater frequency of CAB use and higher demand for alcohol and the majority of the trait impulsivity measure's subscales. Partial correlations indicated significant relationships between CAB use and higher demand and sensation seeking when controlling for variance accounted for by alcohol problems. Furthermore, greater CAB use continued to be associated with higher alcohol problem severity even after controlling for the influence of demographic, impulsivity, and alcohol demand variables.

These findings extend the literature in several ways. Most importantly, this study addresses a gap in the literature examining the increased risks associated with CAB consumption by

systematically controlling for possible collinear factors that may account for negative consequences of CAB use. In their recent critical review of research in this area, Verster et al. (2012) argued that the hazards from CAB use reported in prior research may be attributable to a generally higher propensity to engage in risky behaviors in drinkers rather than to CAB use specifically. However, the present findings, along with those of the initial study by Brache and Stockwell (2011), suggest that the association between CAB use and alcohol-related problems is not purely due to unaccounted for person-level characteristics, at least not in the case of impulsivity and reinforcing value of alcohol. Furthermore, this study assessed a more comprehensive array of potential confounding variables. This included using a multifaceted measure of impulsivity and a validated measure of impulsive decision-making. In doing so, we were able to characterize a broader spectrum of impulsive tendencies in our participants, which further strengthens the conclusion that the connection between CAB use and hazardous drinking is not exclusively attributable to underlying participant characteristics. In the broadest terms, these findings are supportive of the perspective that CAB use is specifically associated with alcohol misuse and do not support the alternative hypothesis that it is an epiphenomenon.

A number of secondary findings are also worthy of discussion. Consistent with the recent findings of Heinz et al (2013), we found significant correlations between CAB use and impulsive personality traits on the UPPS-P. However, our data suggest that the associations between CAB use and certain aspects of impulsivity may be largely attributable to general level of alcohol misuse. In the case of both negative and positive urgency, the magnitude of the correlation with CAB frequency was dramatically reduced when AUDIT score was controlled. The notable exception here was sensation seeking, which continued to be significantly associated with CAB use even after controlling for AUDIT total scores. This suggests that those individuals who have a higher propensity to engage in exciting and potentially dangerous activities are also the ones who tend to consume CABs at a higher rate. Future studies are needed to confirm these associations and also to determine whether these individuals can be specifically targeted in clinical interventions and prevention efforts to reduce additional risks from CABs. Another novel contribution of the present study is the significant associations between impulsive personality traits, as measured by the UPPS-P, and higher demand for alcohol. This suggests that individuals who exhibit higher levels of impulsiveness also tend to place a higher value on alcohol. Finally, these results provide further validation for using alcohol demand as a collateral indicator of alcohol misuse by showing that demand is associated with a specific type of potentially high-risk drinking (e.g., CAB consumption).

The findings should be considered in light of some methodological limitations. First, the generalizability of the patterns observed in this sample to young adult drinkers as a whole is not clear. These findings largely pertain to regular drinkers who were predominately White, female college students. With regard to the gender distribution of the present sample, participants were enrolled on an open basis from an undergraduate research pool and psychology courses that are typically female-dominant. Future studies should specifically target a more equal proportion of male and female participants. This is particularly relevant given the recent data on sex differences in CAB (Wells et al., 2013). As such, an important priority for future research is to further investigate factors that may contribute to increased

risks from CABs in male drinkers. Second, although CAB use was associated with alcohol use and misuse, these findings are cross-sectional and directional causality cannot be determined. It is plausible that CAB use causes greater alcohol-related problems, but increased CAB use itself may also increase as a function of level of heavy drinking. Prospective longitudinal studies are needed to unravel the specific causal relationship between CAB use and alcohol misuse. Third, although the study had a moderately large sample, several relationships were present as statistical trends or were directionally consistent but not statistically significant. This was especially the case for the partial correlations between CAB use and several of the demand indices and the lack of premeditation subscale of the UPPS-P. Future studies with larger sample sizes will be able to clarify these relationships. Fourth, the behavioral economic measures in this study assessed preferences for hypothetical monetary and alcohol rewards raising the question of whether similar effects would be found if actual rewards were at stake. This consideration is mitigated to some extent by prior research indicating relatively close correspondence between hypothetical and actual-outcome measures of delayed reward discounting (e.g., Johnson & Bickel, 2002) and alcohol demand (e.g., Amlung et al., 2012). Finally, the assessment of CAB use was focused primarily on alcoholic mixed with energy drinks and did not take into account other types of ad hoc CABs (e.g., mixing alcohol with caffeinated soft drinks or adding alcohol to coffee drinks).

Taken together, this study provides further evidence that CAB use is associated with greater levels of hazardous drinking above and beyond the influence of collateral risk factors such as impulsivity and demand for alcohol. As a result, these findings further strengthen the empirical basis for development of targeted clinical interventions that specifically address the increased risks associated with CAB use. From a public health standpoint, these results suggest that continued emphasis on programs designed to reduce and prevent CAB use may also help reduce some of the added risks of drinking-related negative consequences that accompany CAB use. However, since this study is only the second to specifically control for collateral risk factors when examining relationships between CAB use and alcohol misuse, these findings should not be considered definitive. Further research is necessary to replicate and extend the present findings, including addressing the methodological issues raised above and examining other potential confounding factors such as other forms of risky behavior (e.g., illicit drug use, risky sexual behavior) and measures of behavioral inhibition (e.g., Fillmore, 2003). In addition, given the increasing evidence that expectancies may contribute to CAB use (Heinz et al., 2013; MacKillop et al., 2012), integrating measures of expectancies, including those for social, cognitive, and affective outcomes, will be important. Finally, future research using other indicators of alcohol misuse such as clinical severity and alcohol problems that are most pertinent to young adult drinkers (e.g., Read, Kahler, Strong, & Colder, 2006) will also help refine the unique risks from CAB use.

Supplementary Materials

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1
Participant characteristics (N = 273)

	Mean (Standard Deviation) / [Range] / %
Sex	73% Female
Age	20.0 (1.7)
Race	Caucasian: 85%; African American: 6%; Asian: 3%; Mixed Race: 2%; American Indian/Alaskan Native: 1%; Other: 3%;
Hispanic Ethnicity	7%
Income	<\$30k: 16%; \$30-60k: 14%; \$60-90k: 19%; \$90-120k: 21%; >120k: 30%
Drinks/week	10.6 (8.2)
AUDIT	8.4 (4.9) [1-24]
CAB Freq.	Not in past month: 55%; 1-2 days: 25%; 3-5 days: 11%; 6-9 days: 5%; 10-14 days: 3%; 15-19 days: 1%
Energy Drink Freq.	Not in past month: 59%; 1-2 days: 24%; 3-5 days: 8%; 6-9 days: 5%; 10-14 days: 3%; 15-19 days: 1%; 20-29 days: <1%; Every day: <1%

Note: AUDIT = Alcohol Use Disorders Identification Test; CAB Freq. = frequency of consuming ad hoc caffeinated alcoholic beverages in last 30 days; Energy Drink Freq. = frequency of consuming non-alcoholic energy drinks in last 30 days.

Table 2
Correlations among CAB Use, Alcohol Misuse, Impulsivity, and Demand for Alcohol

Variable	1	2	3	4	5	6	7	8	9	10	11
1. CAB Freq.	---										
2. AUDIT	.35 ^c	---									
3. APT-Intensity	.30 ^c	.53 ^c	---								
4. APT-Breakpoint	.16 ^b	.21 ^c	.26 ^c	---							
5. APT-O _{max}	.25 ^c	.42 ^c	.44 ^c	.75 ^c	---						
6. APT-Elasticity	-.19 ^c	-.23 ^c	-.37 ^c	-.71 ^c	-.69 ^c	---					
7. MCQ-MICR	.10	.12 ^a	.10	.06	.07	-.05	---				
8. UPPS-NegUrge	.17 ^b	.34 ^c	.19 ^b	.17 ^b	.17 ^b	-.16 ^b	.09	---			
9. UPPS-Premed	.18 ^b	.22 ^c	.17 ^b	.02	.05	-.06	.06	.44 ^c	---		
10. UPPS-Persev	.06	.24 ^c	.09	.03	.04	-.04	.02	.54 ^c	.48 ^c	---	
11. UPPS-SensSeek	.16 ^b	.15 ^a	.27 ^c	.04	.09	-.14 ^a	-.07	.09	.17 ^b	-.12 ^a	---
12. UPPS-PosUrge	.15 ^a	.36 ^c	.19 ^b	.04	.13	-.04	.09	.68 ^c	.39 ^c	.45 ^c	.20 ^b

Note.

^a $p < .05$;

^b $p < .01$;

^c $p < .001$; CAB Freq. = ad hoc caffeinated alcohol beverage consumption frequency; AUDIT = Alcohol Use Disorders Identification Test; APT = alcohol purchase task; MCQ-M ICR = impulsive choice ratio for Multiple Choice Questionnaire medium magnitude; UPPS-NegUrge = negative urgency subscale; UPPS-Premed = lack of premeditation subscale; UPPS-Persev = lack of perseverance subscale; UPPS-SensSeek = sensation seeking subscale; UPPS-PosUrge = positive urgency subscale.

Table 3
Hierarchical Linear Regression of Alcohol Misuse (Alcohol Use Disorder Identification Test) on CAB Frequency, controlling for Sex, Income, Alcohol Incentive Value, and Impulsivity-related Personality Traits

Variable	B	SE	B	95% CI
<i>Step One</i>				
Sex	0.40	0.63	0.04	-0.85, 1.64
Income	0.15	0.09	0.08	-0.03, 0.33
APT-Intensity	3.06	0.49	0.39 ^c	2.10, 4.02
APT-Breakpoint	-0.21	0.16	-0.11	-0.54, 0.11
APT-O _{max}	1.52	0.35	0.36 ^c	0.83, 2.20
APT-Elasticity	6.38	3.98	0.12	-1.46, 14.22
MCQ-M ICR	2.16	1.33	0.08	-0.46, 4.79
UPPS-NegUrge	0.97	0.75	0.10	-0.51, 2.45
UPPS-Premed	0.05	0.69	0.01	-1.30, 1.41
UPPS-Persev	0.95	0.77	0.08	-0.57, 2.46
UPPS-SensSeek	0.05	0.53	0.01	-0.99, 1.09
UPPS-PosUrge	1.33	0.68	0.14 [†]	-0.01, 2.67
<i>Step Two</i>				
CAB Freq	0.58	0.18	0.17 ^b	0.23, 0.93

Note.

[†]
 $p < .10$;

^b
 $p < .01$;

^c
 $p < .001$; 95% CI = 95% confidence intervals; CAB Freq = ad hoc caffeinated alcohol beverage consumption frequency; APT = alcohol purchase task; MCQ-M ICR = impulsive choice ratio for Multiple Choice Questionnaire medium magnitude; UPPS-NegUrge = negative urgency subscale; UPPS-Premed = lack of premeditation subscale; UPPS-Persev = lack of perseverance subscale; UPPS-SensSeek = sensation seeking subscale; UPPS-PosUrge = positive urgency subscale.