Published in final edited form as:

Drug Alcohol Depend. 2012 June 1; 123(0): 273–276. doi:10.1016/j.drugalcdep.2011.11.012.

Gender Differences in Factors Associated with Alcohol Drinking: Delay Discounting and Perception of Others' Drinking

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Abstract

Background—Excessive alcohol consumption in college students is associated with impulsivity and with overestimating levels of others' drinking; however, females' and males' drinking may be differently impacted by their overestimations. We examined whether moderate drinkers discount alcohol rewards differently from money rewards and whether their estimate of others' drinking is more closely associated with own-drinking for males than females.

Method—College students completed two delay discounting tasks in which they chose between money rewards and between alcohol rewards, varying in amount and delay to receipt. Participants also completed questionnaires about their own and others' drinking.

Results—Area under the delay-subjective value curve (AUC) was smaller for alcohol than money rewards, implying steeper discounting of alcohol rewards. Regression analyses showed that females' number of drinks per sitting was related only to AUC for money, while males' drinks per sitting was related to their estimate of others' drinks.

Conclusion—The relationship between alcohol consumption and discounting was replicated. This study also indicated that social norms play a larger role in determining males' drinking than females'.

Keywords

delay discounting; alcohol; college students; peer influence; gender; social norms

1. Introduction

Drinking to intoxication (problem drinking) is prevalent across college campuses and contributes to deaths, injuries, unsafe sex, vandalism, and other problems (Hingson, Heeren, Winter, & Wechsler, 2005). One factor that may contribute to problem drinking is a tendency to discount the value of later consequences, such as feeling healthy and neither sick nor hungover, in favor of immediate pleasures. This decrease in value with increasing delay is referred to as *delay discounting* and may be related to impulsivity. Consistent with this notion, heavy social drinkers devalue delayed hypothetical monetary rewards more than

do light social drinkers (Vuchinich & Simpson, 1998). Also, relative to monetary rewards, the value of alcohol degrades more quickly with increasing delay, even in nondependent subjects (Odum & Rainaud, 2003; Petry, 2001; Tsukayama & Duckworth, 2010).

Another factor influencing problem drinking is that many college students experience pressure to conform to perceived norms for alcohol consumption. However, college students often overestimate peers' alcohol consumption, and perception of peers' drinking is closely related to own drinking (Perkins, Haines, & Rice, 2005; Perkins, Meilman, Leichliter, Cashin, & Presley, 1999; Perkins & Wechsler, 1996). Although both female and male college students overestimate same-sex peers' drinking (Lewis & Neighbors, 2004), this misperception may differentially impact drinking depending on resistance to peer influence. Research on peer influence shows that females are more resistant than are males (Steinberg & Monahan, 2009), which suggests that perceptions of others' drinking may be less related to drinking in females than for males. The current study tested whether the relation between drinking, impulsivity, and perceptions of others' drinking varied for women and men. We hypothesized that heavier drinking would be related to higher impulsivity overall, but that estimates of others' drinking habits would be more related to own drinking for males than for females.

2. Methods

2.1. Subjects

Sixty-five subjects (37 female, 2 unknown gender) aged 18 to 24 years, attending Lewis & Clark College in Portland, OR, or recently graduated, were recruited through campus flyers seeking participants 18 years or older. The Lewis & Clark College Institutional Review Board approved the protocol. Data were collected on campus, and subjects earned \$10.

2.2. Measures

The alcohol self-assessment included 10 questions, and the primary item of interest was: "During the last academic year, how many drinks did you usually have in a typical sitting?"

College Behavioral Norms Questionnaire (CBNQ) is a 14-item questionnaire adapted from the National College Health Assessment (The American College Health Association, 2005). The primary item of interest was: "Imagine a typical Lewis & Clark College student of the same sex as you. How many alcoholic drinks did they have the last time they partied/socialized?"

Subjects also completed a delay discounting task with hypothetical monetary rewards and one with hypothetical alcohol rewards. In the monetary task (based on Mitchell, 1999), subjects were instructed to respond as if their choices were real. Subjects made 69 choices between \$100 available at one of three delays (7, 30, or 60 days) versus an amount between \$0 and \$105 (\$0, \$2.50, \$5, increasing in \$5 increments) available now. All combinations of the two alternatives were presented in random order without replacement. The alcohol task used identical delay and amount parameters to the monetary task, except that choices were between 10 six-packs of beer (or 10 bottles of wine, depending on subjects' preference, stated prior to the task) available after a delay versus a number of six-packs of beer (bottles of wine) between 0 and 10.5. Before the task, subjects were instructed: "assume that you can purchase 10 six-packs of beer for \$100" (or "10 bottles of wine for \$100").

2.3. Data analysis

In the discounting tasks, indifference points were the immediate-reward value at which preference switched between the immediate and delayed alternative (see Mitchell, 1999 for

details of calculation algorithm). Indifference points were converted to a proportion of the delayed reward amount for comparison across money and alcohol tasks. Area under the discounting curve (AUC) was calculated (see Myerson, Green, & Warusawitharana, 2001 for description). AUC theoretically ranges from 0 to 1 but may exceed 1 if, within a single delay, subjects never choose the alternative available now, even when the amount available now exceeds the delayed amount. AUCs for money ranged from 0.232 to 1.058, and AUCs for alcohol ranged from 0.199 to 0.999 (lower AUC typically corresponds to steeper discounting).

Of the 65 subjects enrolled, one subject's discounting alcohol (beer) data were removed because these data did not meet Johnson and Bickel's (2008) criterion 1, which classifies data as non-systematic if an indifference point is greater than the indifference point associated with the adjacent (i.e., shorter) delay by more than 20% of the larger-later reward. Another subject did not complete the discounting tasks. Two subjects' beer/wine preferences were not recorded, and two other individuals did not complete the alcohol drinking and gender assessment.

3. Results

3.1 Discounting delayed alcohol and delayed money

All ANOVAs included Huyn-Feldt corrected degrees of freedom where appropriate. Indifference points for money rewards exceeded those for alcohol rewards, and indifference points decreased as delay increased. A four-way ANOVA examining the effects of gender, beer/wine preference, commodity, and delay on indifference points showed that delayed alcohol had less subjective value than delayed money (commodity main effect: $F(1,55)=19.01, p<0.001$), and delay decreased the subjective value of both money and alcohol (delay main effect: $F(1.44, 79.23)=48.29, p<0.001$). There was a marginally significant gender $\times$ commodity $\times$ delay interaction, $F(1.50, 82.39)=3.47, p=0.049$, which appeared to be attributable to the indifference points at the longest delay for money and alcohol being more similar for men than for women (Figure 1). There was no preference $\times$ commodity $\times$ delay interaction, and there were no other significant main effects or interactions.

Results from analysis of AUCs were consistent with indifference point analyses. AUCs for money exceeded those for alcohol, $F(1, 55)=17.13, p<0.001$, and were unaffected by preference for beer or wine $F(1, 55)=0.01, p=0.923$ or by gender $F(1,55)=2.12, p=0.151$, nor were there any significant interactions. Subjects who had larger AUCs for money also had larger AUCs for alcohol ($r=0.28, p=0.026$).

3.2 Discounting and drinking habits

Subjects drank an average of 3.18 drinks per sitting ($SD: 2.11$), with a trend towards males consuming more than females (males: $M(SD)=3.81(2.87)$; females: $M(SD)=2.71(1.13)$, $t(30.75)=-1.84, p=0.075$. In this sample, preference for beer or wine did not differ between males and females; $\chi^2=0.21; df=1; p=0.648$. However, those who preferred beer over wine reported consuming more drinks ($N=45, M(SD)=3.38(2.09)$) than wine-preferring subjects ($N=14, M(SD)=2.14(1.35)$; $t(57)=2.07, p=0.043$). *T*-tests indicated no relation between beer/wine preference and discounting delayed alcohol or money.

Overall, consuming more drinks was negatively correlated with AUC for money ($r=-0.36, p=0.005$) but surprisingly not with AUC for alcohol ($r=-0.106, p=0.424$). However these relationships differed markedly for female and male subjects. For females, consuming more drinks was negatively correlated with AUC for both money ($r=-0.43, p=0.012$) and alcohol

($r=-0.41, p=0.016$), suggesting higher levels of drinking were associated with higher levels of impulsivity. In contrast, for males, consuming more drinks was not significantly correlated with either AUC for money ($r=-0.38, p=0.080$) or alcohol ($r=-0.01, p=0.979$).

3.3 Own drinking habits and estimates of others' drinking habits

Overall, consuming more drinks was correlated with higher estimates of typical students' drinks per sitting ($r=0.58, p<0.001$). However, this relationship was primarily driven by data from male subjects. For males, consuming more drinks was strongly associated with higher estimates of others' drinking ($r=0.62, p=0.001$), while this relationship was not robust in females ($r=0.30, p=0.077$). Further, higher estimates of others' drinking was not correlated with AUC for money (overall: $r=-0.18, p=0.167$; males: $r=-0.01, p=0.959$). However, this correlation trended toward significance for females ($r=-0.32, p=0.057$). There were no correlations between estimate and AUC for alcohol for the group or gender-based subsets.

Because there appeared to be differences between males and females in drinking variables, we conducted a stepwise regression to assess which variables were related to drinks per sitting for each gender. Candidates included AUC for alcohol, AUC for money, and estimate of others' drinks. For females, the best-fitting model included only AUC for money ($\beta_{AUC}=-2.79, p=0.012, R^2=0.18$). For males, the best-fitting model included both AUC for money and estimate of others' drinks ($\beta_{AUC}=-6.09, p=0.023; \beta_{estimate}=0.95, p<0.001; R^2=0.55$).

4. Discussion

The current study replicated several previous results. Delayed alcohol was discounted more than delayed money, and individual variation in the amount of discounting extended across commodities in that subjects who heavily discounted money also heavily discounted alcohol. This is consistent with previous studies comparing discounting of money and alcohol rewards (Petry, 2001; Tsukayama & Duckworth, 2010). Studies have indicated that larger delayed rewards are discounted less steeply than smaller delayed rewards (for review see Green & Myerson, 2004). Thus, the current results could also be obtained if subjects valued 10 units of alcohol less than \$100, in spite of the instructions to assume equal value. Odum & Rainaud (2003) did equalize subjective values of the maximum money and alcohol rewards on a within-subjects basis, and as in the current study, delayed alcohol rewards were more steeply discounted than money rewards.

The results also showed that, for female subjects, alcohol consumption was positively correlated with discounting delayed monetary rewards. This demonstrates that the discounting measure is sufficiently sensitive to distinguish between drinkers defined not by their dependence status but use, extending findings showing differences in discounting between light or heavy alcohol user (Vuchinich & Simpson, 1998). Similarly, alcohol consumption was positively associated with discounting delayed alcohol rewards, extending results from dependent alcohol drinkers (Petry, 2001). It is not clear why these relationships were not observed for males, but this warrants additional research with larger samples.

Overall, subjects who drank more estimated that typical same-sex students also drank more, in accord with previous research (Beck & Treiman, 1996; Perkins & Wechsler, 1996; but also see Baer, 2002). However, this relation between drinking and estimates of others' drinking reached significance only for males. Thus, when considering factors related to higher levels of drinking, different pictures emerged for each gender. For females in this sample, drinking was related to sensitivity to delayed rewards and not to perceptions of others' drinking, whereas for males, drinking was only related to perception of others' drinking. This reduced importance of social norms in determining females' drinking compared to males' implies that drinking-reduction campaigns based on altering social

norms could be especially effective if targeted toward males, although such campaigns have been effective for both genders (Larimer & Cronce, 2007). Overall mixed outcomes by norms-based campaigns aiming to reduce drinking (Larimer & Cronce, 2007) suggest that future studies should continue to examine the role of gender in intervention outcomes. Indeed, short-term outcomes of alcohol interventions overall were more positive if the program included more female subjects (Carey, Scott-Sheldon, Carey, & DeMartini, 2007).

The gender differences observed are intriguing and warrant additional study. However, these results must be interpreted cautiously for three main reasons. First, several correlations trended towards significance, and additional subjects may have produced significant results. Second, the study lacked highly-detailed information about drinking habits, whereas including these measures may have allowed comparisons based on binge-drinking criteria (Courtney & Polich, 2009). Third, Kypri and Langley (2003) found that, in contrast to the current results, own drinking was more highly correlated with perceived norms for women than for men in a much larger sample than ours from New Zealand University. Borsari & Carey (2001) also review several studies showing correlations between perceived norms and own drinking for both genders. To explore gender differences in the relationship between estimates of others' drinking and own drinking, future studies should examine whether women and men use different sources of information to formulate estimates. Further, future research should examine whether college-age females are more resistant to peer influence about alcohol use than are males, and how other factors besides social norms, like discounting, are relevant to females in deciding how much to drink.

References

- The American College Health Association. The American College Health Association National College Health Assessment (ACHA-NCHA), Spring 2003 Reference Group Report. *J Am Coll Health*. 2005; 53:199–210. [PubMed: 15813230]
- Baer JS. Student factors: Understanding individual variation in college drinking. *J. Stud. Alcohol*, Supplement No. 2002; 14:40–53.
- Baer JS, Carney MM. Biases in the perceptions of the consequences of alcohol use among college students. *J. Stud. Alcohol*. 1993; 54:54–60. [PubMed: 8355500]
- Beck KH, Treiman KA. The relationship of social context of drinking, perceived social norms, and parental influence to various drinking patterns of adolescents. *Addict Behav*. 1996; 21:633–644. [PubMed: 8876762]
- Borsari B, Carey KB. Peer influences on college drinking: A review of the research. *J Subst Abuse*. 2001; 13:391–424. [PubMed: 11775073]
- Carey KB, Scott-Sheldon LAJ, Carey MP, DeMartini KS. Individual-level interventions to reduce college student drinking: A meta-analytic review. *Addict Behav*. 2007; 32:2469–2494. [PubMed: 17590277]
- Courtney KE, Polich J. Binge drinking in young adults: Data, definitions, and determinants. *Psychol Bull*. 2009; 135:142–156. [PubMed: 19210057]
- Green L, Myerson J. A discounting framework for choice with delayed and probabilistic rewards. *Psychol Bull*. 2004; 130:769–792. [PubMed: 15367080]
- Hingson R, Heeren T, Winter M, Wechsler H. Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18–24: Changes from 1998 to 2001. *Annu Rev Public Health*. 2005; 26:259–279. [PubMed: 15760289]
- Johnson MW, Bickel WK. An algorithm for identifying nonsystematic delay-discounting data. *Exp Clin Psychopharmacol*. 2008; 16:264–274. [PubMed: 18540786]
- Kypri K, Langley JD. Perceived social norms and their relation to university student drinking. *J Stud Alcohol*. 2003; 64:829–834. [PubMed: 14743946]

- Larimer ME, Cronce JM. Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999–2006. *Addict Behav.* 2007; 32:2439–2468. [PubMed: 17604915]
- Lewis MA, Neighbors C. Gender-specific misperceptions of college student drinking norms. *Psychol Addict Behav.* 2004; 18:334–339. [PubMed: 15631605]
- Mitchell SH. Measures of impulsivity in cigarette smokers and non-smokers. *Psychopharmacology (Berl).* 1999; 146:455–464. [PubMed: 10550496]
- Myerson J, Green L, Warusawitharana M. Area under the curve as a measure of discounting. *J Exp Anal Behav.* 2001; 76:235–243. [PubMed: 11599641]
- Odum AL, Rainaud C. Discounting of delayed hypothetical money, alcohol, and food. *Behav Processes.* 2003; 64:305–313. [PubMed: 14580700]
- Perkins HW, Haines MP, Rice RM. Misperceiving the college drinking norm and related problems: A nationwide study of exposure to prevention information, perceived norms, and student alcohol misuse. *J Stud Alcohol Drugs.* 2005; 66:470–478.
- Perkins HW, Meilman PW, Leichliter JS, Cashin JS, Presley CA. Misperceptions of the norms for the frequency of alcohol and other drug use on college campuses. *J Am Coll Health.* 1999; 47:253–258. [PubMed: 10368559]
- Perkins HW, Wechsler H. Variation in perceived college drinking norms and its impact on alcohol abuse: A nationwide study. *J Drug Issues.* 1996; 26:961–974.
- Petry N. Delay discounting of money and alcohol in actively using alcoholics, currently abstinent alcoholics, and controls. *Psychopharmacology (Berl).* 2001; 154:243–250. [PubMed: 11351931]
- Steinberg L, Monahan KC. Age differences in resistance to peer influence. *Dev Psychol.* 2007; 43:1531–1543. [PubMed: 18020830]
- Tsukayama E, Duckworth AL. Domain-specific temporal discounting and temptation. *Judgm Decis Mak.* 2010; 5:72–82.
- Vuchinich RE, Simpson CA. Hyperbolic temporal discounting in social drinkers and problem drinkers. *Exp Clin Psychopharmacol.* 1998; 6:292–305. [PubMed: 9725113]

Figure 1.

Median subjective value of money (dark symbols) and alcohol (light symbols) rewards. Subjective value is the indifference point expressed as a proportion of the larger-later reward (\$100 or 10 units of alcohol). A: Females (N=36; circles) and males (N=25; triangles); B: Beer-preferring subjects (N=46; circles) and wine-preferring subjects (N=15; triangles).