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Binge drinking in undergraduates: Relationships with gender, drinking behaviors, impulsivity and the perceived effects of alcohol

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Abstract

Binge drinking on university campuses is associated with social and health-related problems. In order to determine the factors that may predict this behavior, we collected information on alcohol use, alcohol expectations, and impulsivity from 428 undergraduate students attending a Canadian university. The subjective effects of a binge-drinking dose of alcohol were assessed in a subset of participants. In the larger sample, 72% of students reported drinking at or above binge drinking thresholds on a regular basis. Men reported alcohol consumption per drinking occasion that was consistent with other studies, but the frequency of drinking occasions among women was higher than previous studies, suggesting that consumption in women may be increasing. Compared to men, women reported different expectations of alcohol, specifically related to sociability and sexuality. Self-reported impulsivity scores were related, albeit weakly, to drinking behaviors and to expectations in both sexes. Finally, intoxicated binge drinkers reported feeling less intoxicated, liking the effects more and wanting more alcohol than did non-binge drinkers receiving an equivalent dose of alcohol. These results have implications for gender-specific prevention strategies for binge drinking on university campuses

Keywords

Binge; Ethanol; College Drinking; Personality; Expectation; Sex Differences

Introduction

Alcohol consumption on college and university campuses has gained attention not only because undergraduate students drink significantly more than adults, but also because they drink more than young adults who do not attend university (Slutske, 2005). In one of the first comprehensive studies of college drinking, Henry Wechsler and colleagues (1994) surveyed over 17,000 US college students in 140 colleges and found widespread binge drinking, with 44% of students reporting drinking at binge levels. Binge drinking is defined as consumption of 5 drinks for men and 4 drinks for women within two hours, such that the blood alcohol concentration (BAC) is raised to 0.08 gram percent or above (NIAAA, 2004).

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Socially, alcohol-related problems associated with binge drinking include missing a class, driving after drinking, and engaging in unplanned and unprotected sex (Wechsler and Nelson, 2001). Binge drinking has further second-hand effects in that students who attend schools with high rates of drinking (even those who remain abstinent), are more likely to have property damaged, their study or sleep interrupted, the responsibility of taking care of a drunken student, or the experience of unwanted sexual advances (Wechsler and Nelson, 2001). As such, binge drinking among college students is a prevalent behavior that has clinical and social implications.

Heavy alcohol consumption within a short period of time (i.e., binge drinking) may be particularly detrimental for college-aged students because motivational neurocircuitry underlying risk, reward and decision-making continues to develop during this period (Crews, et al., 2000; Chambers et al., 2003; Monti, et al., 2005). Consistent with this idea, binge ethanol consumption during adolescence in animals is associated with damage of frontal brain areas (Crews et al., 2000). Moreover, the repeated abuse of alcohol combined with detoxification is associated with brain damage to frontal areas important for cognitive control (Duka et al., 2004). Repeated drinking binges and withdrawal from alcohol, therefore, may reinforce problematic drinking by damaging the very brain areas that mediate executive function and inhibitory control. This fits with evidence that young adult binge drinkers demonstrate a range of cognitive impairments on tasks measuring impulse control, when compared to their non binge-drinking counterparts (Weissenborn and Duka, 2003; Townshend and Duka, 2005;).

The relationship between impulsivity and substance abuse, however, is not straightforward. Impulsivity in binge drinkers may predate alcohol consumption in that personality traits, including impulsiveness, are related to age of first drink and are a further related to alcohol use disorders and binge drinking in college students (Vuchinich and Simpson, 1998; Dougherty et al., 2005; Goudriaan et al., 2007; MacKillop et al., 2007; Diemen et al., 2008). Impulsivity is a multifaceted construct that has been defined as a predisposition toward rapid, unplanned reactions to stimuli with diminished regard to the negative consequences (Evenden et al., 1999; Moeller et al., 2001; Potenza, 2007). Thus, impulsivity may promote binge drinking through two processes; trait impulsivity may predispose individuals to excessive alcohol consumption, and alcohol consumption itself may lead to further impairments in self-control that are manifested as disinhibited intake.

The relationship between impulsivity and binge drinking must be considered within the context of gender differences. The findings on impulsivity are equivocal in that some studies report higher impulsivity in males that is related to substance use (Waldeck and Miller, 1997; Zuckermann and Kuhlmann, 2000), whereas others report no gender differences in impulsive traits (Reynolds et al., 2006). Gender differences in alcohol consumption and the expected effects of alcohol appear more straightforward. Men report higher rates of binge drinking, more frequent drinking occasions, and greater levels of binge drinking than do women (Wechsler et al., 1994; 1995; O'Malley and Johnston, 2002; Gliksman et al., 2003). Men also report greater positive expectancies from alcohol, are more likely to drink as a coping mechanism (Nolen-Hoeksema, 2004; Harrell and Karim, 2008), and report greater expectations of social assertion and sexual enhancement with alcohol (Brown et al., 1980; Mooney et al., 1987; Ham and Hope, 2003).

More recent studies suggest a gender convergence in drinking habits with female alcohol consumption approaching that of males (Gliksman et al., 2003; Wechsler et al., 1994; 1995; Nolen-Hoeksema, 2004; Keyes et al., 2008). This shift could reflect psychosocial factors such as changing expectations of the effects of alcohol in females. For example, a qualitative study examining drinking attitudes in female college students reported that women preferred

to socialize with men, over women, when intoxicated and considered heavy drinking as making a favorable impression on men (Young et al., 2005). These findings would be enhanced by quantitative data comparing alcohol expectations in men and women.

In addition to impulsivity and alcohol expectancies, binge drinking may be influenced by motivational states induced by alcohol intoxication. More specifically, subjective responses to alcohol may influence subsequent drinking behavior, and this relationship could be modified by other factors such as gender. Only a handful of studies have examined this possible connection, and the resulting data are inconclusive. For example, some studies report greater disinhibitory effects of alcohol in binge drinkers (Marczinski et al., 2007), whereas others do not (Rose and Grunsell, 2008). Both studies, used relatively small samples and did not investigate gender differences, leaving the question open to further investigation.

The present study sought to examine factors related to heavy drinking, in male and female undergraduate students at a Canadian university. Information on self-reported drinking behaviors, alcohol expectancies and trait impulsivity was gathered through questionnaires administered while students were participating in laboratory experiments examining the behavioral effects of alcohol (Balodis et al., 2006; Balodis et al., 2007). Because the data were collected in a controlled laboratory setting, we were able to assess how participants perceived the effects of an intoxicating dose of alcohol. Therefore a further goal of the study was to relate the subjective measures of intoxication, while participants are in an intoxicated state, to the self-reported drinking habits and expectancies of the students. Thus, this is one of the first studies to examine the subjective perception of a binge-like dose of alcohol in a large sample of male and female undergraduates.

Consistent with other studies, we hypothesized that a large proportion of the undergraduates would report patterns of binge drinking and that the mean number of drinks consumed would be higher in men than women. Using the 4/5 measure (NIAAA, 2004), we also hypothesized that binge drinking, alcohol expectancies, and the perceived effects of alcohol would be associated with self-reported impulsivity. Given the relationship between alcohol use disorders and impulsivity, we hypothesized that higher levels of impulsivity and greater alcohol use would be associated with more positive expectations of alcohol (Werner et al., 1995; Read et al., 2004). Consistent with previous reports of alcohol-related expectancies in males, we hypothesized that men as compared with women would report greater expectations of social assertion and sexual enhancement when intoxicated. Finally, we hypothesized that a binge-level dose of alcohol would produce different motivational states in binge and non-binge drinkers, irrespective of gender.

Methods

Participants

Data were collected from 428 Queen’s University students between 2002 and 2007. Participants were recruited through classes and a student volunteer subject pool. Eligibility criteria included that participants consumed alcohol at least once per month. Approximately 15% of all participants sampled did not meet this criterion. Participants were 276 male and 152 female undergraduate students ranging in age from 19–31 years, with a mean age of 20. Data collection was approved by the Queen’s University General Research Ethics Board.

Measures

Self-report measures

The Barratt Impulsiveness Scale: The Barratt Impulsiveness Scale (BIS), version 11, was used as a self-report measure of impulsiveness. The BIS is a 30-item questionnaire with Non-planning, Motor and Cognitive Impulsiveness subscales. Participants rate themselves on statements using a 4-point scale: rarely/never, occasionally, often or almost always. Items on the BIS are moderately correlated with each other and the scale shows a high test-retest reliability (Patton et al., 1995; Fossati et al., 2001). Three-hundred and twenty-eight participants completed this measure.

Personal Drinking Habits (PDH): This self-report questionnaire contains questions regarding an individual's drinking habits, including the frequency, amount and length of drinking occasions (Balodis et al., 2006; Balodis et al., 2007). This questionnaire was completed by 295 participants.

Comprehensive Effects of Alcohol Questionnaire (CEOA): The Comprehensive Effects of Alcohol Questionnaire (CEOA) is a measure of discrete alcohol expectancies, including both positive and negative factors (Fromme et al., 1993). The self-report questionnaire consists of 38 statements, first using a 4-point Likert scale to examine an individual's expectation as to whether they are under the influence of alcohol. These same 38 statements are then subjectively evaluated on a 5-point Likert scale, in which the individual rates the particular effect as good, bad or neutral. The CEOA, therefore, provides information on the subjective valuations of alcohol (expectancies) as well as general evaluations of alcohol's effects (evaluations). Items on the CEOA have been categorized into domains of Sociability, Tension Reduction, Liquid Courage, Sexuality, Cognitive and Behavioural Impairments, Risk and Aggression and Self-Perception. The CEOA demonstrates good test-retest reliability as well as construct and criterion validity (Fromme et al., 1993). This questionnaire was completed by 121 participants.

Drug Effects Questionnaire (DEQ): Participants completed a manipulation check self-report measure to examine the perceived level of intoxication and to judge the effectiveness of the placebo manipulation. A modified version of the Drug Effects Questionnaire (Kirk and De Wit, 2000) was used, including visual analogue scales of 'feel' effects, 'like' effects and 'want more'. This questionnaire was completed by 399 participants.

Blood Alcohol Concentrations: Blood alcohol concentrations were estimated through Breath Alcohol Level (BAL) using the Intoxilyzer 400D, a handheld breath alcohol testing instrument. Participants blew air through a mouthpiece into a fuel cell which measured the alcohol concentration in the expired breath.

Study Procedure: Participants completed the BIS, PDH and CEOA upon entering the lab. Participants were randomly assigned to 1 of 3 treatment groups: sober (n = 139), placebo (n = 56) or intoxicated (n = 195). Participants in the intoxicated condition received 0.7g/kg of alcohol; individuals in this group were weighed at the beginning of the session so that each participant would receive the same amount of alcohol per body weight. The intoxicated group received 3 alcoholic drinks consisting of a 2:1 ratio of Fresca soda to Vodka (40% alcohol), so as to raise their blood-alcohol level (BAL) to 0.08%, the legal limit in Ontario. Participants in the placebo group were also weighed and informed that they were receiving alcohol; however, their drinks consisted of a 2:1 ratio of Fresca soda and flattened tonic water. The glasses of the participants in the placebo group were rimmed with alcohol in a manner that did not influence the BAL of participants. The control group was informed that they were not receiving any alcohol. Participants watched two episodes of 'The Simpsons'

(totaling ~45minutes) while consuming the drinks. The appropriate alcohol mixture was divided into 3 glasses, each consumed at 10–15 minute intervals. Following beverage consumption and task completion, participants completed the DEQ. Full description of the alcohol administration procedure is described elsewhere (Balodis et al., 2006; Balodis et al., 2007). Binge drinking in the current study was defined as the consumption of 4 drinks for women and 5 drinks for men over a short period of time, in line with NIAAA guidelines (NIAAA, 2004).

Results

Gender Drinking Characteristics and Drinking Behaviors

In our sample, students reported an average of 6.5 (*SD* = 4.23) drinking occasions per month with a mean of 5.99 (*SD* = 2.92) drinks consumed on each occasion. The average length of a drinking session was 4.69 (*SD* = 1.31) hours. Two one-way ANOVAs with gender as a between-subjects variable revealed that men reported more drinking occasions than did women [$F(1, 291) = 9.92$, $p < 0.01$] and consuming more drinks on these occasions [$F(1, 291) = 31.72$, $p < 0.001$]. Specifically, men reported a mean of 7.27 (*SD* = 4.3) drinking occasions on which they consumed an average of 6.82 drinks and women reported a mean of 5.77 (*SD* = 3.87) drinking occasions with an average of 5.05 alcoholic beverages consumed at these times. There was no difference in the length of drinking occasions between genders [$F(1, 291) = 1.25$, $p > 0.05$; *M* = 4.76 (*SD* = 1.37) for males and *M* = 4.58 (*SD* = 1.24) for females].

From the 293 participants who completed the PDH, 72% (*n* = 210) reported drinking at or above the binge-drinking threshold, with 69% (*n* = 102) of women reporting having consumed 4 or more drinks and 75% (*n* = 109) of men reporting having consumed 5 or more drinks on drinking occasions (Table 1). These individuals constituted the binge drinking group; non-binge drinkers were comprised of 25% of the male sample (*n* = 37) and 31% of the female sample (*n* = 46) who respectively reported drinking less than 5 or 4 drinks per drinking occasion. Multiple one-way ANOVAs examining personal drinking habits between binge drinking and non-binge drinking undergraduates revealed differences in the number of drinking occasions per month [$F(1, 291) = 8.89$, $p < 0.01$] and in the lengths of these drinking occasions [$F(1, 291) = 33.13$, $p < 0.001$]. Binge drinkers reported higher levels for these variables; the mean number of drinking occasions per month was 6.96 (*SD* = 3.7) on which they consumed an average of 7.1 (*SD* = 2.4) over the span of 4.9 hours (*SD* = 1.1). Non-binge drinkers reported a mean of 5.3 (*SD* = 5.0) drinking occasions per month, on which they consumed an average of 3 (*SD* = .85) drinks over the span of 4 (*SD* = 1.5) hours.

Multiple one way ANOVAs examining personal drinking habits in binge and non-binge drinkers with gender as a between-subjects variables revealed no significant interaction between gender and drinking status in the number of drinking occasions per month [$F(1, 289) = .004$, $p > 0.05$] or the length of these drinking occasions [$F(1, 289) = .351$, $p > 0.05$]. There was, however, a significant interaction between gender and binge-drinking status for the number of drinks consumed on drinking occasions [$F(1, 289) = 9.07$, $p < 0.01$], in that binge-drinking men consumed more drinks (*M* = 8.1, *SD* = 2.6) than did binge-drinking women (*M* = 6.1, *SD* = 1.8). Male non-binge drinkers (*M* = 3.2, *SD* = .94) did not consume significantly more drinks on drinking occasions than did female non-binge drinkers (*M* = 2.8, *SD* = .72).

When study participants were questioned whether they had ever consumed more than their average amount in the past two years, 92.8% of participants replied affirmatively. On such occasions, the mean number of drinks reported having been consumed was 10.8 (*SD* = 5.6),

with men reporting more drinks having been consumed [$F(1, 258) = 18.42$, $p < 0.001$; $M = 12.2$, $SD = 6.1$) than did women ($M = 9.3$, $SD = 4.7$).

Barratt Impulsiveness Scale

The overall mean score on the Barratt Impulsiveness Scale (BIS) was 63.96 ($SD = 9.6$; $N = 333$). Multiple one-way ANOVAs revealed no difference between genders on the BIS [$F(1, 325) = 0.66$, $p > 0.05$] or its Non-planning [$F(1, 325) = 0.11$, $p > 0.05$], Motor [$F(1, 325) = 0.00$, $p > 0.05$] and Cognitive [$F(1, 325) = 2.35$, $p > 0.05$] subscales. Multiple one-way ANOVAs examining BIS scores and binge-drinking status showed no differences in scores between binge and non-binge drinkers on the total BIS score [$F(1, 197) = 0.875$, $p > 0.05$], the Non-planning [$F(1, 197) = 0.384$, $p > 0.05$], Motor [$F(1, 197) = 0.403$, $p > 0.05$], and Cognitive [$F(1, 197) = 1.05$, $p > 0.05$] subscales (Table 1). Correlations significant at $p < 0.05$ were observed between the BIS score and personal drinking habits reported by participants. The number of drinks consumed per drinking occasion was positively correlated with the BIS total score ($R = .209$; $p < 0.01$). In particular, the Motor subscale loaded heaviest onto the total BIS score ($R = .224$; $p = 0.001$), followed by the Cognitive subscale ($R = .176$; $p < 0.05$) (Table 2).

Comprehensive Effects of Alcohol Questionnaire (CEOA)

The CEOA results are based on the responses of 51 males and 69 females. Multiple one-way ANOVAs examining alcohol expectations on the CEOA showed a significant difference between genders in Sociability Expectations [$F(1, 118) = 8.29$, $p < 0.01$], Tension Reduction [$F(1, 118) = 6.48$, $p < 0.05$], and Sexuality Expectations [$F(1, 118) = 7.68$, $p < 0.01$]. Specifically, women reported higher Sociability and Sexuality Expectations, while men reported greater Tension Reduction Expectations with alcohol. In evaluating the general effects of alcohol, a one-way ANOVA showed women to have greater Sociability Evaluations than men [$F(1, 117) = 4.13$, $p < 0.05$]. There were no gender differences in Negative Expectations or Evaluations on any of the subscales ($p > 0.05$).

When compared to non-binge drinkers, binge drinkers did not show differences in responses on the CEOA ($p > 0.05$). However, the BIS total score and its Cognitive and Non-planning subscales correlated positively with Negative Expectations on the CEOA ($p < 0.05$). Cognitive Behavioral Expectations on the CEOA accounted for the significant relationship between Negative Expectations and the BIS total score ($R = 0.24$; $p < 0.01$). This CEOA subscale was also related to the Cognitive ($R = 0.26$; $p < 0.01$) and Non-planning ($R = 0.2$; $p < 0.05$) subscales of the BIS (Table 2).

There were significant inverse correlations between Sexuality Expectations on the CEOA and impulsivity on the BIS ($R = -0.23$). Specifically, lower levels of Motor ($R = -0.22$), Cognitive ($R = -0.19$) and overall impulsivity ($R = -0.23$) were associated with higher Sexuality Expectations (each $p < 0.05$). Inverse correlations were also found between Sexuality Evaluations and scores on both the entire BIS score ($R = -0.194$, $p < 0.05$) and its Non-planning subscale ($R = -0.2$; $p < 0.05$). These results are displayed in Table 2.

Drug Effects Questionnaire

Responses to the Drug Effects Questionnaire were examined using multiple one-way ANOVAs in the sober ($n = 75$), placebo ($n = 43$) and intoxicated ($n = 148$) group participants who completed the questionnaire. There were significant main effects of experimental group in feeling drunk [$F(2, 261) = 183.82$, $p < 0.001$], liking the effects $F(2, 261) = 10.61$, $p < 0.001$], but not in wanting more to drink [$F(2, 261) = 2.64$, $p = 0.07$]. Specifically, the intoxicated group rated themselves as significantly more drunk than both the placebo and the sober group ($p < 0.01$) and the placebo group rated themselves as

significantly more intoxicated than the sober group ($p < 0.05$). For liking the effects that they feel, the sober group responded with significantly higher ratings than did both the placebo and the intoxicated group ($p < 0.05$), while these latter two groups did not differ from each other.

There were no significant main effects of binge drinking status in feeling drunk [$F(2, 261) = 2.74$, $p > 0.05$], or liking the effects that they feel [$F(2, 261) = .001$, $p < 0.05$]. There was, however, a significant main effect of wanting more to drink $F(2, 261) = 9.49$, $p < 0.01$] whereby binge drinkers reported higher ratings of wanting more than non-binge drinkers ($p < 0.01$).

A significant interaction between experimental group and binge drinking status showed a significant difference in feeling drunk [$F(2, 261) = 3.4$, $p < 0.05$] and wanting more to drink [$F(2, 261) = 3.33$, $p < 0.05$]. Specifically, in the intoxicated group, binge drinkers reported lower ratings of feeling drunk than did non-binge drinkers ($p < 0.001$) and reported higher ratings of wanting more than did non-binge drinkers ($p < 0.001$). There were no significant differences in intoxicated ratings, or wanting more to drink between binge drinking groups in the placebo condition ($p > 0.05$).

Figure 1 shows results from the DEQ examining the subjective effects of alcohol intoxication in the 148 undergraduates in the intoxicated group. Multiple one-way ANOVAs showed significant gender differences in their ratings of feeling sober or drunk [$F(1, 146) = 11.08$, $p < 0.01$], or on wanting more alcohol [$F(1, 146) = 4.72$, $p < 0.05$]. Specifically, men ($n = 81$) as compared to women ($n = 67$) rated themselves as significantly less intoxicated and as wanting more alcohol ($p < 0.05$).

A multivariate 2-way ANOVA with binge drinking and gender included as main factors revealed that, when intoxicated, binge and non-binge drinkers differed significantly in their ratings of feeling sober or drunk [$F(1, 143) = 13.63$, $p < 0.001$], liking the effects [$F(1, 143) = 9.58$, $p < 0.01$] and wanting more [$F(1, 143) = 22.13$, $p < 0.001$]. Specifically, binge drinkers reported feeling significantly less intoxicated, but gave higher ratings for liking the effects and wanting more to drink, when compared to the non-binge-drinking group ($p < 0.01$). There was also a significant interaction between gender and binge-drinking status for liking the effects of intoxication [$F(1, 143) = 5.67$, $p < 0.05$] showing that non-binge-drinking women reported liking the effects of intoxication significantly less than non-binge-drinking men ($p < 0.05$).

Blood Alcohol Concentrations

The BALs of participants who consumed alcohol was .089, SD = .004. The mean BAL for the individual groups was as follows: non-binge drinking males BAL = .086, SD = .028; non-binge drinking females BAL = .085, SD = .033; binge drinking males BAL = .078, SD = 0.26; and binge drinking females BAL = .105, SD = .061. An ANOVA with BAL as the dependent variable and gender and binge drinking status as fixed factors revealed no significant differences between binge and non-binge drinkers [F(1, 143) = .629, p = .429], or between males and females [F(1, 143) = 2.843, p = 0.94] and no gender by binge-drinking status interaction [F(1, 143) = 3.048, p = .083].

Discussion

Consistent with our hypotheses and with larger surveys, a significant proportion of undergraduate students in our study reported patterns of binge drinking. These rates were significantly higher in men than in women. However, gender differences in personal drinking behaviors varied according to binge-drinking status; male binge drinkers reported

consuming more alcohol than female binge drinkers, yet male non-binge drinkers did not differ from non-binge drinking females in the amount of alcohol they reported consuming.

Although there was no significant relationship between binge drinking and impulsivity scores, the latter were correlated with personal drinking habits, most notably drinks per drinking occasion. Impulsivity scores were also related to higher levels of negative expectations of alcohol, particularly those relating to cognitive and behavioral impairments. Furthermore, less impulsive individuals reported greater alcohol-related sexual expectations and woman reported higher expectations of Sociability and Sexuality than their male counterparts. Finally, intoxication produced different subjective effects in binge drinking and non-binge drinking undergraduates. Binge drinkers reported feeling less intoxicated, while exhibiting a higher preference for the effects of intoxication and wanting more alcohol. The implications of these findings are discussed below.

The mean reported number of drinks consumed per drinking occasion by men in our study was 6.82, similar to the 7.51 drinks reported by males in the Canadian Campus Survey (Gliksman et al., 2003) and the 5.9 drinks reported in American surveys (Slutske, 2005). In contrast, the mean of 5 drinks per drinking occasion reported by females in our study is slightly higher than these Canadian and American studies (4 and 3.8 respectively; Gliksman et al., 2003; Slutske, 2005). These results are consistent with the idea that the gender gap in the college drinking culture may be shrinking and that, with each new cohort, female levels of heavy drinking are becoming closer to those of males (Pederson & LaBrie, 2006).

Using the 5/4 measure of drinking, we found that 72% of our sample reported consumption rates at binge-drinking levels. Specifically, the mean alcohol consumption reported by 74% of males and 69% of females during a drinking occasion met or surpassed the binge drinking thresholds, as defined by the National Institute on Alcohol Abuse and Alcoholism. In addition to regular patterns of binge drinking, over 90% of students also reported consuming more than their average amount in the past 2 years. Indeed, both males and females reported mean alcohol consumption, on at least one occasion, that was more than double the binge threshold; 12 drinks for males and 9 for females. The 5/4 measure of binge drinking has previously been criticized for implying that all students who drink beyond this level suffer the same level of risk (White et al., 2006). As an example, more than half of the students in our sample could be categorized as binge drinkers, but it is not clear what proportion of these may suffer long-term negative consequences as a result of their drinking. If binge drinking in undergraduate populations is to be studied (and treated) effectively, the criteria for this behaviour may need to be refined in order to identify maladaptive and dangerous drinking patterns in this group.

Contrary to our hypothesis, binge drinkers did not exhibit higher trait levels of impulsivity than non-binge drinkers. This could reflect the misclassification of binge drinkers in our sample using the 5/4 criterion, or the fact that self-report and behavioral measures of impulsivity do not always correlate (Reynolds et al., 2006). Moreover, not all studies support a relationship between binge drinking and impulsivity (MacKillop et al., 2007; Rose and Grunsell, 2008) suggesting that impulsivity may not predict all aspects of alcohol misuse. Nonetheless, BIS scores were correlated (albeit weakly) with the number of drinks consumed per drinking occasion and with the length of these occasions (Table 1). These data, therefore, demonstrate that a continuous measure detects a relationship that is otherwise not observed when individuals are dichotomized into non-binge and binge drinking groups. If these measures are taken as indirect evidence for binge-like drinking patterns, the results are consistent with evidence that for high impulsivity scores in college students who binge drink or misuse alcohol (Goudriaan et al., 2007; MacKillop et al., 2007). Our findings also fit with the notion that higher BIS scores may reflect greater risk for

impaired control, an important factor in predicting heavy episodic drinking and alcohol-related problems (Leeman et al., 2007). An important next step in this investigation is to examine whether pre-existing differences in trait impulsivity predict later patterns of alcohol misuse.

Similar to the analysis of impulsivity, our study did not reveal differences between binge and non-binge drinkers in the expectations or evaluations of alcohol's effects. There was, however, a relationship between scores on the CEOA and impulsivity in that individuals with higher negative expectations of alcohol also had higher levels of impulsivity, particularly in cognitive and non-planning domains. This finding is consistent with those describing higher impulsivity in college students with alcohol use disorders (Vuchinich and Simpson, 1998; MacKillop et al., 2007) as individuals with higher negative alcohol expectations may experience greater alcohol-related problems (Rose and Grunsell, 2008). Closer examination of the data, however, revealed that this effect was substantially due to the Behavioral Impairment Expectations Subscale of the CEOA. This subscale also correlated positively with the Cognitive Impulsivity Subscale of the BIS. The relationship between negative expectancies and alcohol use, therefore, may not be straightforward; problem drinkers report expectations of alcohol improving cognitive/motor abilities (Lewis and O'Neill, 2000) and heavy drinkers may perceive some of the cognitive and behavioral effects of intoxication as positive (Ham and Hope, 2003). Items on the CEOA such as 'My senses would be dulled', or, 'My responses would be slow' from the Cognitive/Behavioral Impairment Subscale may therefore be perceived by impulsive individuals as positive outcomes. If this is true, cognitive impulsivity may represent an important factor moderating alcohol-related expectancies related to cognitive and behavioral impairments and alcohol misuse. This finding has implications for treatment interventions as individuals with high levels of cognitive impulsivity may be more likely to misuse alcohol in order to experience subjective alterations in cognitive states.

We also observed a negative correlation between the impulsivity and sexual expectations suggesting that less impulsive individuals view alcohol intoxication as a means to lower sexual inhibitions. These findings may help to explain how sexual expectancies of alcohol intoxication moderate the relationship between alcohol use and risky sexual behavior (Dermen et al., 1998). Although the data are preliminary, it is possible that the misuse of alcohol may be mediated by disparate expectations in different groups. This may explain why studies do not consistently report higher rates of impulsivity in binge drinkers.

As predicted, we observed gender differences in alcohol expectations and subjective evaluations of intoxication. In particular, women reported having greater sociability expectations, meaning that they consider themselves and others to be significantly more sociable with alcohol. Our finding of increased sexual expectations in female participants conflict with previous studies demonstrating greater expectancies of social assertion, sexual enhancement and arousal in male drinkers (Brown et al., 1980; Mooney et al., 1987). This may suggest a significant shift in gender- expectancies of alcohol congruent with the increased drinking rates reported in females. Given that women express a preference for socializing with men, over women, when intoxicated (Young et al., 2005), their sociability outlook may also be related to their sexuality expectations. One hypothesis is that women who drink more heavily may be shunning traditional gender roles in drinking patterns, not in an attempt to achieve the same social position as men, but rather because women perceive this behavior to be more sexually appealing to men (Young et al., 2005). Using qualitative data, Young and colleagues (2005) suggested that the ability of college women to "drink like a guy" was based on an expression of the women's sexuality. Women in her study emphasized that they did not want a social position exchangeable with men, but rather expressed that matching drinking patterns was more appealing to men and granted them an

elevated social position relative to other women. Although our sample is relatively small, these findings may be the first to reflect changes in subjective valuations in women related to the expected effects of alcohol intoxication. The gender differences in alcohol expectations may play a further role in changing drinking patterns and, although speculative, may reflect influences of some advertisements that promote a sexual and liberating image in association with alcohol consumption. These findings have additional implications in that positive and arousing alcohol expectancies have been associated with a blunted response to negative affect cues and may represent a form of implicit cognition related to biopsychosocial antecedents influencing drinking behavior (Fishman et al., 2008; Drobes et al., 2009).

Interestingly, both female and male binge drinkers reported similar subjective increases in stimulation, enhanced motivation and desire to consume more alcohol, suggesting a greater disinhibitory effect of intoxication in binge drinking individuals. In the current study, participants received 0.7g/kg of alcohol in less than 1 hour, a dose sufficient to raise the Blood Alcohol Level to 0.08%. Although all participants received the same amount of alcohol relative to their body weight and there were no significant differences in the BALs of different groups, binge drinkers (both male and female) reported feeling less intoxicated than non-binge drinkers. This finding may reflect a physiological difference between groups, potentially related to tolerance effects, as binge drinkers in the placebo group did not differ from non-binge drinkers in their ratings of feeling drunk, although both groups reported increased feelings of intoxication. Furthermore, binge drinkers reported greater liking of the intoxicating effects of alcohol as well as a greater desire to consume more alcohol than non-binge drinkers. These findings suggest that binge drinkers may have a higher tolerance for the intoxicating (e.g. disorienting) effects of alcohol, yet still experience greater pleasurable sensations. Schuckit and colleagues (2008) have reported that, in young nondependent drinkers, self-reported tolerance is further associated with alcohol-related problems and therefore presents additional clinically relevant information about an individual.

Combined with their increased desire to consume more alcohol when intoxicated, the binge-drinking group appears particularly prone to high levels of alcohol intake. Our findings are consistent with those reported by Marczinski and colleagues (2007) who found that, following a 0.65g/kg dose of alcohol, binge drinkers reported greater feelings of stimulation when compared to non-binge drinkers. That study also demonstrated greater inhibition failures on Go/No-Go Task performance in intoxicated binge drinkers. This dissociation between the perception of being less intoxicated, yet demonstrating greater behavioral impairments, appears to represent a particularly hazardous combination.

Study Strengths and Limitations

Altogether, the findings in these studies suggest a heightened disinhibitory reaction to alcohol following intoxication in binge drinkers affecting both cognitive and behavioral processes. To date, relatively few studies have examined gender differences in the perceived effects of alcohol in intoxicated undergraduate students comparing binge and non-binge drinkers. Our study provides novel information on the relationship between drinking patterns and perceived drug effects, particularly showing that binge-drinking females demonstrate alcohol-related cognitions more similar to males, than to their non-binge drinking counterparts. In addition, the alcohol expectancies reported in women, particularly those related to socialability and sexuality, have important implications for identifying important influences on drinking behavior, as well as for intervention efforts, which are often less effective in women than in men (Dunn et al., 2000; Corbin et al., 2001).

Limitations of the current study include a relatively small sample and the use of self-report measures. Our data are also limited in that information was collected over several years and

different experiments (Balodis et al., 2006; Balodis et al., 2007). Therefore the number of participants assessed with specific measures varies. Our data are derived from undergraduate students who reported consuming alcohol at least once per month. Based on this criterion, approximately 15% of students were not eligible for participation in the studies. Nonetheless, our observed drinking frequencies are largely consistent with rates reported in larger Canadian and American studies. Indeed, the similarity across studies in the prevalence of heavy drinking among 19 and 20 year-olds in American college samples provides evidence that chronological age, rather than legal drinking age, is a more important determinant of alcohol consumption (Kuo et al., 2002). Additionally, the high proportion of women with high levels of alcohol consumption in our study suggest that Canadian undergraduate drinking trends may be moving in parallel with American patterns. This increase is particularly concerning as women, due to metabolic differences, have greater proportions of alcohol entering the bloodstream than do men who drink the same amount (Frezza et al., 1990).

Conclusions

The results of the current study highlight the prevalence of high levels of alcohol consumption on university campuses as well as a gender convergence in drinking patterns. Notably, a heightened disinhibitory response to acute intoxication may make both male and female binge drinkers more vulnerable to alcohol-related problems. The modest correlations we observed between impulsivity and both drinking habits and alcohol expectations point to a need for further examination of the factors that influence drinking patterns. Finally, gender differences in self-reported expectations of alcohol's effects (specifically those related to sociability and sexuality) provide further evidence for differential motivations to consume alcohol consumption in young women and men. These findings have significant implications for alcohol marketing and prevention strategies targeting binge-drinking behaviors. For example, prevention strategies may be most effective when they are gender-specific and target maladaptive alcohol evaluations and expectations particular to each gender.

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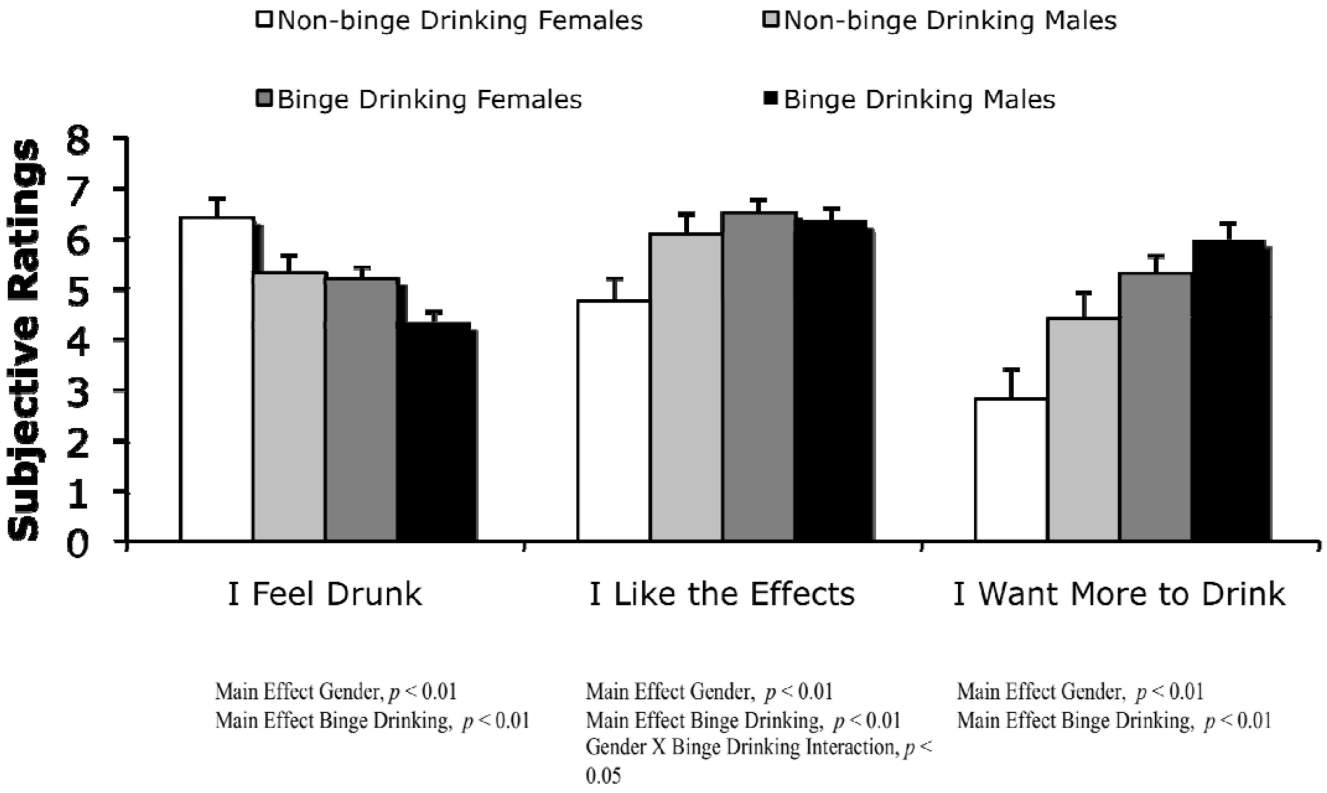

Figure 1.

Subjective ratings on the Drug Effects Questionnaire in Non-binge Drinking Females (*n* = 17), Non-binge Drinking Males (*n* = 22), Binge Drinking Females (*n* = 51) and Binge Drinking Males (*n* = 59). Non-binge drinking females rated themselves as significantly more intoxicated than all other groups. Non-binge Drinking Males and Binge Drinking Females reported greater intoxication than Binge Drinking Males. Female Non-binge drinkers reported liking the effects of intoxication less than all other groups. Binge Drinking Males reported significantly higher ratings of wanting more alcohol compared to Non-binge Drinking Males and Non-binge Drinking Females. Overall, Binge Drinkers (both males and females) reported significantly lower ratings of feeling intoxicated, but higher ratings of liking the effects of intoxication more and wanting more alcohol.

Table 1

Participant Demographics and Characteristics for Males and Females

Group Characteristics	Males	Females	Total Mean
Age	20 (0.14)	20 (0.14)	20 (0.10)
Drinking Occasions per Month	7.27 (0.34) *	5.77 (0.34)	6.5 (0.24)
Drinks Consumed per Occasion	6.82 (0.23)*	5.05 (0.22)	5.94 (0.16)
Length of Drinking Session (hrs)	4.76 (0.11)	4.58 (0.11)	4.67 (0.08)
% Binge Drinkers	74.48%	68.92%	71.67 %
Barratt Impulsivity Score (BIS)	64.25 (0.64)	63.33 (0.94)	63.96 (0.57)
BIS in Non-Binge Drinkers	63.78 (2.16)	62.10 (2.07)	68.91 (1.50)
BIS in Binge Drinkers	65.58 (1.20)	63.48 (1.18)	64.51 (0.84)

Data are presented as mean (SEM).

* $p < 0.05$

Table 2

Pearson correlations of the Barratt Impulsivity Scale (BIS) with Personal Drinking Habits and the Comprehensive Effects of Alcohol Questionnaire (CEOA).

	BIS Total Score	Nonplanning Subscale	Motor Subscale	Cognitive Subscale
Personal Drinking Habits				
Drinking Occasions per Month	.108	.135	.112	.015
Drinks per Drinking Occasion	.209**	.122	.224**	.176*
Length of Drinking Occasions	.142*	.072	.120	.160*
CEOA				
Negative Expectations	.226*	.201*	.132	.213*
Cognitive Behavioral Impairment Expectations	.243**	.196*	.134	.258**
Sexuality Expectations	−.225*	−.153	−.218*	−.194*
Sexuality Evaluations	−.194*	−.196*	−.143	−.130

* $p < .05$ (2-tailed);

** $p < .01$ (2-tailed)